CANADIAN SCHOOL GEOGRAPHY

CORNISH

A CANADIAN SCHOOL GEOGRAPHY

BY

GEORGE A. CORNISH, B.A.

ASSOCIATE PROFESSOR, COLLEGE OF EDUCATION (METHODS IN SCIENCE), UNIVERSITY OF TORONTO

WITH NUMEROUS SKETCH MAPS, DIAGRAMS AND ILLUSTRATIONS

AUTHORIZED FOR USE IN THE SCHOOLS OF BRITISH COLUMBIA

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The Waters a vessel would
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R. St. L.
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PREFACE

CANADIAN schools have been too long tied down to United States text-books in Geography, either adapted or made over. Every paragraph of a good text-book in geography is permeated with the atmosphere of the country in which it is to be used. To adapt or make over such a book for another country quenches its fire, and it becomes lifeless and uninteresting. To write a text-book from the Canadian standpoint has been the purpose of the present author. The subject matter, the comparisons, the maps, and the illustrations have the Canadian atmosphere.

This text-book differs in several respects from those with which Canadian educationists are most familiar.

1. The map has been made the centre about which the practical work of the pupil is built up. What the apparatus is to the student of chemistry, and crayons and paints to the student of art, maps and pictures are to the student of regional geography. The performance by the pupils of the many projects in this text will give them such skill in interpretation that, given a proper set of maps of an unknown region, they will be able to write its geography. Not only are the maps to be used in working out the projects but also in reading every page of the book.

2. But to use maps to advantage they must be numerous, of the right kind, and in such a convenient form that they can be consulted with ease and comfort while reading the text. No Canadian text-book in geography has ever had as great an assortment of maps as is given in the Atlas which accompanies this volume. But it is particularly in their character that the maps are distinguished from those found in the ordinary Canadian text-book. The political map with its variegated checker-board of colours, which obscures all those features most important to understand the geography of a region, and which every educational expert in geography condemns, has all but disappeared from the Atlas and we are given maps showing physical features, vegetation, rainfall, temperature, productions, and those other features, which colouring is necessary to distinguish. Moreover, the maps are not so crowded with unimportant names as to blur those other features that it is intended to make conspicuous. Only such names as are likely to be referred to in teaching the subject are given in the maps.

3. In order to make the maps convenient for reference they are bound up in a separate volume. As a rule several maps showing different features of the same region are placed on opposite pages, so that a pupil may have five or six maps of the same continent or country before him to consult while he reads his text. Where the maps are scattered throughout the text-book, pupils will not put themselves to the inconvenience of turning to different parts to consult the maps.

4. The binding of the maps in a separate volume allows the text-book to be made of a convenient size for holding in the hand. The large geography text-book has always been awkward to hold, to place in the desk, and to put in the school-bag.

5. The practical work is placed as projects at the beginning of most of the chapters. All educationists recognise the great importance of this method in teaching. Projects, in which the pupil is interested, are to be worked out by the pupil himself from the maps and pictures. He thus has an opportunity to interpret the geography of a region for himself before it is read in the text or taken in class.

6. It is now thoroughly recognised that commercial geography is of the first importance, and that it is of as great value and of much greater interest to have a connected knowledge of the geography of the chief commercial products as of the chief countries. This text-book, recognising this fact, has devoted to commercial geography a section in which the geography of the chief articles of commerce is described in an elementary way.

7. Physical geography gives the general principles; and in studying regional geography these principles are constantly applied. Consequently, regional geography is so dependent on physical that no rational understanding of the former is possible without an elementary knowledge of the latter. A very elementary account, therefore, of physical geography is placed at the beginning of the book, but no attempt is made to explain such difficult topics as the tides, the influence of the earth's rotation on winds, etc.

8. Particular care has been taken in the selection of pictorial illustrations. They have been obtained from every part of the world, not snap-shots, but pictures taken by professional photographers attached to Government departments, railways, and big industrial establishments. Only the most perfect of these have been selected, and each has been made large enough to show clearly the features it was desired to illustrate.

The sketch maps have mostly been specially drawn by the author, and the maps on the distribution of agricultural products have been adapted from those contained in the *Geography of the World's Agriculture* by V. C. Finch and O. E. Baker.

Annabelle

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A CANADIAN SCHOOL GEOGRAPHY

PART I. GENERAL GEOGRAPHY

CHAPTER I

THE EARTH, ITS SHAPE, SIZE, AND MOTION

Projects

Sec. 1. Observation of horizon.—For this observation select a piece of land, as level as possible, or better still a large body of water. On a clear day observe the position of the most distant objects you can see in every direction. The sky seems to come down to these objects. The line surrounding the observer, where the sky and earth seem to meet, is called the *horizon*. What shape is the horizon? Go to as high a point as possible and again observe the shape of the horizon. Can you now see farther than before? On the shore of a large body of water observe the most distant objects you can see over the surface of the water (*a*) when lying down, (*b*) when sitting, (*c*) when standing.

Sec. 2. Observation of the heavenly bodies.—Wait for a cloudless, moonlight night. Fix the position of a bright star toward the south. A good way to do this is to point a ruler at the star and to fasten the ruler in this position. Observe the position of the star one or two hours later. Has it moved toward the east or toward the west? Find out whether other stars appear to move in the same way. Next fix the ruler in line with the moon and observe the moon's position an hour or two later. Does the moon appear to move across the sky like the stars? Repeat the experiment next day with the sun. In what direction do the sun, moon, and stars appear to move?

Sec. 3. To study the course of the sun in summer and winter.—Find the exact directions of north, south, east, and west. Late in June observe the exact directions in which the sun rises and sets and the time of rising and setting. Does it rise north or south of

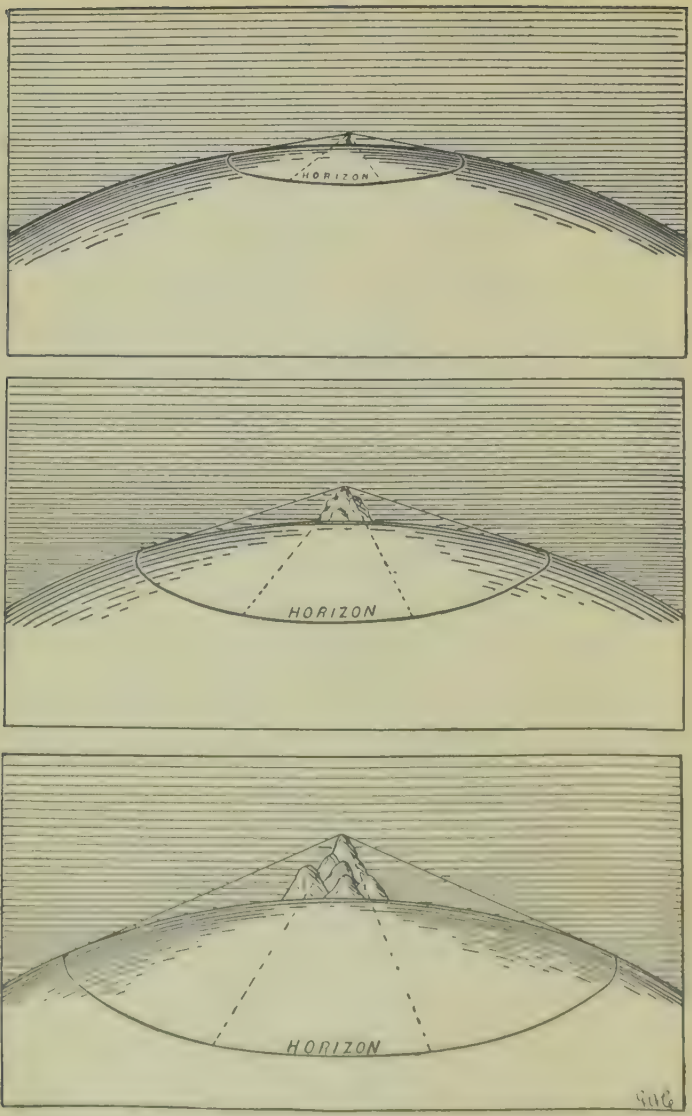


FIG. I. SHOWING THAT THE HORIZON INCREASES IN SIZE AS ONE ASCENDS

east? Does it set north or south of west? For how many hours during the day does it shine? Observe its course across the sky from hour to hour throughout the day. At about what time does it reach its highest position in the sky? Does it ever get directly overhead? Near the end of September observe where it rises and sets, its course across the sky, and the time of rising and setting. Make similar observations on a day near the end of December. On which day does it shine for the greatest number of hours? Give two reasons why a day in June is warmer than a day in December.

The Shape of the Earth

Sec. 4. Is the earth flat?—For many centuries men believed the surface of the earth to be flat. Of course everyone knew that there were hills and hollows, but these were thought of as small irregularities, which could be neglected in describing the whole area. This flatness of the earth was supposed to be perfectly illustrated by the surface of large bodies of water. But as thoughtful men studied the earth more carefully, they observed facts which, if the earth were really flat, were hard to explain. For example, if the earth were flat one should be able to see right across a plain or a body of quiet water, though it were many miles wide. But it is well known that we can see only a few miles along the surface in any direction, for the sky all around seems to come down to meet the land or water, forming the line known as the horizon. If the observer is standing not on the plain but on the top of a hill, he can see farther in every direction, but still a circular horizon limits his view. Now if the surface of the earth be flat, there seems to be no reason why one should see farther from an elevated position than from the level. But if the surface of the earth be curved, then, as Fig. 1 shows clearly, there will be an horizon limiting the view; and the higher one climbs the farther away will be this bounding horizon. In the upper figure the observer is only slightly above the curved earth, and his horizon is represented by a small circle. In the next figure he is higher up and the horizon is represented by a much larger circle. In this second position he sees much farther. The third figure shows that from a still higher position he can see farther still. Hence the reason for the enlarging of the horizon, as one ascends, is quite clearly explained if we assume that the surface of the earth is curved. Moreover, as these facts can be observed at all points on the surface of the earth, it seems that every part of it is curved.

Another fact that made thoughtful people believe that the earth

had a curved surface was the difference in the appearance of ships when seen near at hand from their appearance when seen farther away. When they are far away (Fig. 2) only the tops of the masts or the smoke from their funnels can be seen. Now, since the body, or hull, of the ship is much larger than the mast, it ought to be seen more readily than the mast if the sea is flat. But Fig. 2 shows clearly that on a curved surface the tops of the masts and the smoke would be seen first (3), then the lower parts of the masts (2), and last of all the hull of the ship (1). A person at B can see nothing below the line AC. He can see right to the bottom of the hull of the ship at 1, only the upper parts of the hull and the masts at 2, and nothing but the highest part of the smoke cloud at 3. Thus a curved earth explains clearly this second fact, while a flat earth gives no explanation.

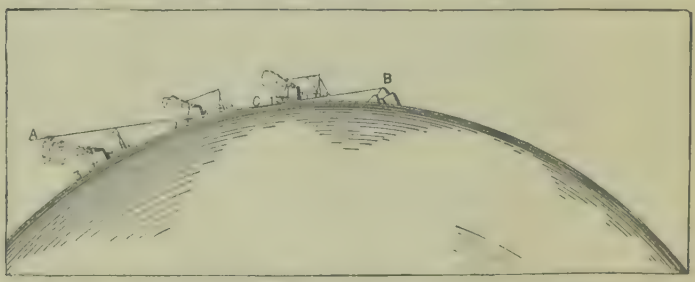


FIG. 2. SHOWING WHY, AS A SHIP APPROACHES, THE MAST IS SEEN BEFORE THE HULL

Sec. 5. The earth is a globe or sphere.—For the reasons just mentioned, as well as for others, we now believe that the surface of the earth is curved, and further, that the earth is round like a ball or an orange. It was because Christopher Columbus believed the earth to be a globe or sphere that he sailed westward to reach Asia, while all travellers to Asia before his time had sailed eastward. And when Columbus had discovered America he believed he had reached Asia, and was of that opinion till the day of his death. The great explorer, Magellan, finally settled the question as to whether the earth was a sphere or a flat platform-like surface. By sailing westward, one of his ships encircled the earth; and many men have travelled around the earth since Magellan's day.

It seems strange to think that we live on the surface of a spherical body. But the earth seems flat to each observer only because it is so very large. If a fly walked about on the surface of a ball as large as a house, the little insect would never suspect that it

was walking on a curved surface, for the small part of the ball that it could see at one time would appear quite flat. It seems stranger still to think that there are boys and girls running around on the surface of the earth directly opposite to us. Let us try to learn why there would be no danger of their falling off. If we let

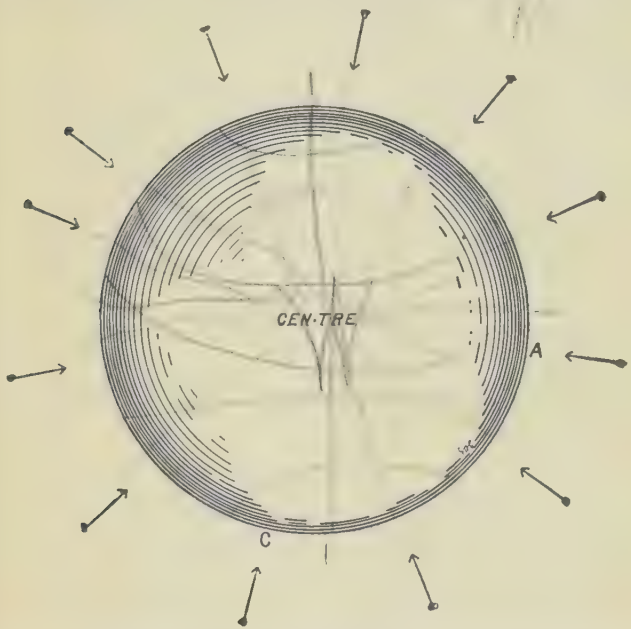


FIG 3 THE ARROWS SHOW THE DIRECTIONS IN WHICH OBJECTS FALL AT DIFFERENT PARTS OF THE SURFACE OF THE EARTH

go of heavy objects, they fall straight to the earth. At all parts of the earth the same thing takes place. Fig. 3 shows objects at various places around the earth, and the arrows show the directions in which they fall. Since a stone always falls straight down, this drawing shows that the direction, down, is not the same in all parts of the earth, for the arrows point in various directions. Now we see that there would be no danger of the boy at A or C dropping off, for he would tend to drop in the direction of the arrow, and would be held to the earth just as you are.

The Size of the Earth

Sec. 6.—It was stated just now that the reason the earth appears flat is that we can see such a small part of it at one time. It is so large that it is very hard for us to imagine its size. Magellan's ship took about three years to sail round the world; but he had only small sailing vessels and met with many delays. Within the last few years men have competed to find who could encircle the earth in the shortest time. The holder of the record has succeeded, by travelling on the fastest ships and trains, in going round the earth in thirty-six days. If an aeroplane flew at the rate of one hundred miles an hour, it would take it 10½ days to encircle the earth, while it would take three hours to go from Montreal to Toronto. This gives you a better idea of the great distance around the earth than to say that it is twenty-five thousand miles in circumference. All have heard of the great heights of the mountains and of the profound depths of the oceans, yet so large is the earth that, if it were represented by a globe eighteen inches in diameter, the highest mountain would have to be shown by a fine grain of sand, and the deepest sea would be represented by a thin coat of paint. If a very smooth croquet ball were enlarged until it became as big as the earth, the projections on it would be higher than the highest mountains, and the hollows on it would be deeper than the deepest ocean.

The Rotation of the Earth

Sec. 7. The movements of the heavenly bodies.—For thousands of years people have eagerly studied the stars and many interesting stories have been imagined about them. It was very early observed that they change their positions in the sky. If a stick is pointed straight at a star in the southern sky and held in that position, in a few minutes it will be observed that the star is no longer in line with the stick but has apparently moved westward. No matter what star is observed, or at what hour of the night the observation is made, all the stars will be seen to move across the sky in the same direction. New stars are continually rising in the east and others are setting in the west. If the stick is fixed in line with the moon, in a few minutes the moon is seen to be no longer in line with it, but, like the stars, has moved westward. In fact, the moon, too, moves steadily across the sky from east to west. All boys and girls have seen the full moon rise in the east, and if they rose very early the next morning they might see it setting in the west. All know that the sun appears to move across the sky from east to west.

If you look into the sky, it appears like a beautiful blue dome or inverted bowl. Thousands of years ago people thought there really was a spherical dome surrounding the earth. They further thought, too, that this sphere was made of something like glass, and that the sun, moon, and stars were lights fixed in this crystal sphere. The sphere was supposed to turn round, carrying all the heavenly bodies with it. Thus they explained the movement of the heavenly

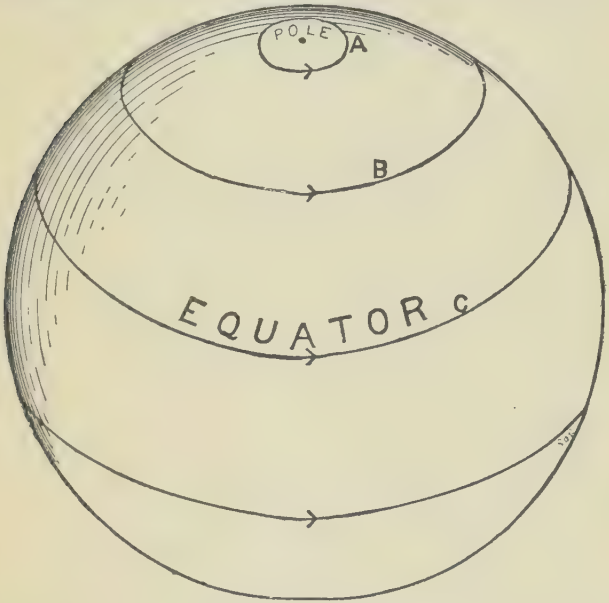


FIG. 4. SHOWING THE POLE AND EQUATOR

bodies across the sky. We now know that this explanation is entirely wrong.

Sec. 8. Do the heavenly bodies really move?—Sometimes when you are in a railway train at a station there may be another train on a track beside you. When one train starts, it is quite impossible to know for certain whether it is yours or the other train. Or if you are on a boat which, unknown to you, is turning round, all the objects along the shore appear to be moving around you rapidly in the opposite direction to that in which the boat is turning. As one spins around on a whirligig, trees, houses, and fences seem

to spin in the contrary way. Thus when we are on a moving object, we are likely, if we do not feel it moving, to think that it is still, and that surrounding objects are moving in the opposite direction. This is exactly what takes place as we stand on the earth and look at the stars. They, as well as the sun and moon, seem to move from east to west, but it is really the earth that is spinning around from west to east.

Sec. 9. The rotation of the earth.—If a ball is placed on a table and given a quick twist, it spins like a top. The earth spins just like the ball, but it has no table to rest upon, for it is out in space. It makes about one complete turn in a day. If pins are stuck in different parts of the spinning ball, it may be observed that some pins move through larger circles than others. The nearer the pin is to the top or the bottom of the spinning ball the smaller the circle through which it moves. If a pin is fixed right at the top of the ball, it does not move round a circle at all but only turns round. Conditions are very similar upon the rotating earth. There are two points at which there is no circular motion; these are called the *poles*. Near the poles (Fig. 4) objects on the earth revolve in small circles, as at A; farther away in larger circles, as at B; while at C, half-way between the two poles, objects move around the largest circle of all. The circle round the earth at C, midway between the poles, is called the *Equator*.

The Directions

Sec. 10. The chief directions.—As a top spins on a table, it does not always remain upright but may sway from side to side. The earth's position does not vary like that of a top, but we can think of the line joining the two poles as always pointing in the same direction. This line, called the *axis* of the earth, points nearly toward a star, which is called the *pole-star*. The pole of the earth nearest this star is the *north pole*, while the opposite point is the *south pole*. The direction along the surface of the earth toward the north pole we call *north*, the direction toward the south pole we call *south*. The arrows in Fig. 5 point north or south according as they are marked N. or S. If one faces due north and stretches his arms straight out on each side of his body, the direction to which the right hand points is called *east*, and the direction to which the left hand points is called *west*.

Sec. 11. How we find the directions.—The sun is due south of us at noon, hence the shadow cast at twelve o'clock noon by an erect post will fall directly north of the post. If the position of the shadow on the ground is marked and the letter S is placed

at the end of it next the post, and the letter N at the end of it farthest from the post, we have a line running north and south suitable as a guide in finding the directions. By facing the north and extending the arms we can find the east and west as indicated above.

At night the directions must be found in a different way. You must first find the pole-star. This will have to be pointed out to

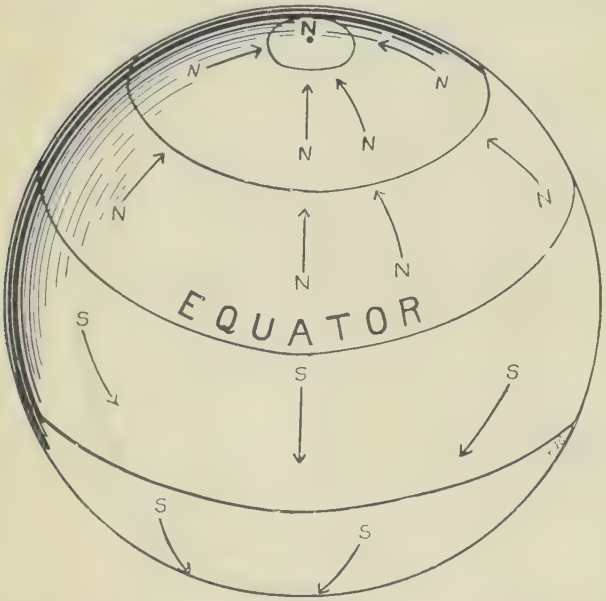
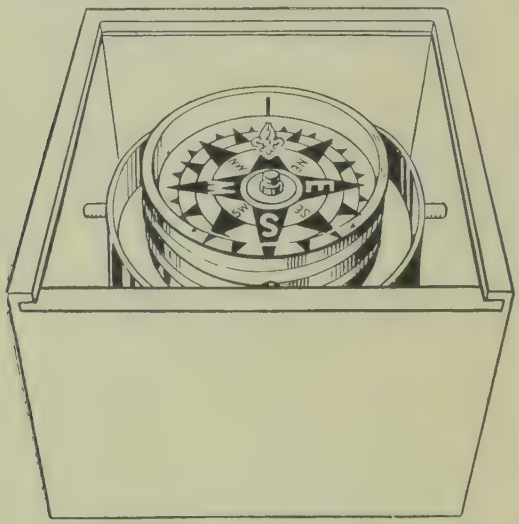


FIG. 5. SHOWING THE DIRECTIONS NORTH AND SOUTH

you by your teacher or parents, but once you have found it you will always be able to find it again. Now if you walk toward the pole-star, you are walking nearly north, and once you have found north the other directions are obtained in the manner just described. We must not try to find the directions from the rising and setting of the sun. Some books say that the sun rises in the east and sets in the west. This is true only for two days in the year. In the summer the sun rises far to the north of east and sets far to the north of west, and in the winter it rises far to the south of east and sets far to the south of west.

It has been found that a hard piece of steel, such as a sewing needle, which has been rubbed along the end of a magnet, behaves in a strange way. If suspended by a thread so as to lie horizontally or balanced on a sharp point, it places itself nearly in a north and south direction. Accordingly it can be used for finding the directions. If such a needle is balanced on a sharp point and set in a case we have a *compass*. It is by means of such an instrument that sailors find the directions. Fig. 6 shows the type of instrument used on shipboard. It is called the *mariner's compass*.



[*From Catalogue of Philip Harris, Birmingham*

FIG. 6. MARINER'S COMPASS

Latitude and Longitude

Sec. 12. How to locate positions on the earth.—It is important to be able to fix or locate the exact position of any place on the earth's surface. In order to do this, especially out on the ocean where there are no landmarks, it is necessary to have some lines of reference. In a city there are often two sets of streets running at right angles to each other. If one set runs north and south, the other set runs east and west (Fig. 7). Now if in the figure we select two of the principal streets that cross each other, such as Monclair and Somerled Avenues, then it is possible to locate any

house by reference to these avenues. For example, A's position is described by saying that it is three streets west of Monclair Avenue and two streets south of Somerled Avenue. B is four streets east and one street north. By a somewhat similar device positions are located on the surface of the earth. Two sets of lines, which cut each other at right angles, are drawn on maps or globes. Figs. 8 and 9 show the globe with some of these lines on it.

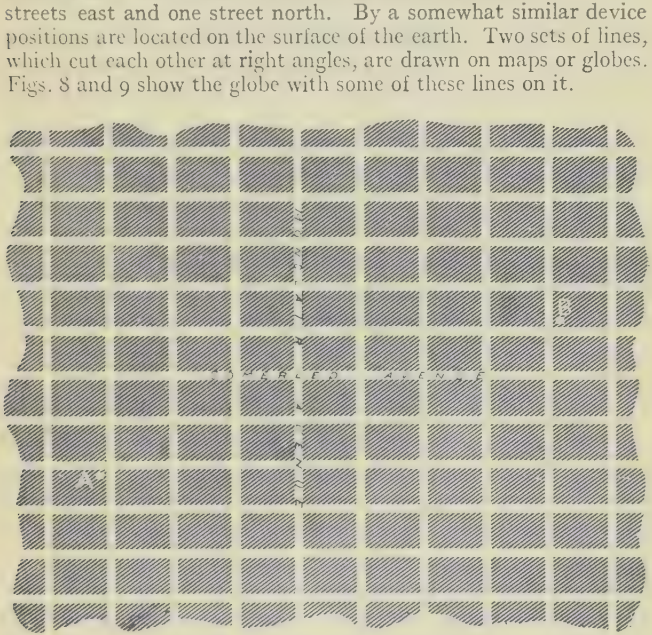


FIG. 7. DIAGRAM OF CITY STREETS

Sec. 13. Latitude.—In Fig. 8 the lines running east and west are drawn. They are all circles passing around the earth parallel to the Equator and are called *parallels of latitude*. In this drawing only a few of these lines are represented, but the distance between the Equator and each of the poles is divided by such lines into 90 parts of equal width, and the width of each part is called a *degree*. Thus we say that a place is at "9 degrees north latitude" if it is on the ninth line north of the Equator. If a place is south of the Equator we say that it is in south latitude. The distance from the Equator to the pole is one-fourth of the distance around the earth, so that it measures $\frac{1}{4}$ of 25,000 miles, or 6250 miles. Therefore the distance between any two parallels of latitude or across 1 degree is $\frac{1}{90}$ of 6250 miles, which is nearly 69$\frac{1}{2}$ miles.

Sec. 14. Longitude.—The circles in Fig. 9, each of which runs north and south through the poles, are called *meridians*. There are 180 of these circles passing round the earth, thus dividing its surface into 360 equal sections. The distance between each two lines is called a *degree of longitude*. Longitude is measured east and west of the meridian that passes through Greenwich near London.

Fig. 10 shows both parallels of latitude and meridians of longitude. We say that the city of Quebec is approximately in 47 degrees north latitude and 71 degrees west longitude. This means that it is near the 47th parallel of latitude north of the Equator and near the 71st meridian west of Greenwich.

The meridians of longitude differ from the parallels of latitude

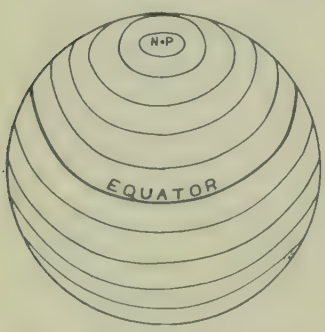


FIG. 8. SHOWING PARALLELS OF LATITUDE

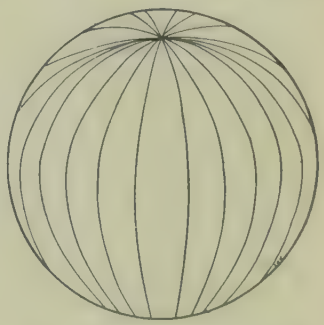


FIG. 9. SHOWING MERIDIANS

in two important respects. First, the meridians are not parallel but, owing to the shape of the globe, are farthest apart at the Equator and draw closer together as they approach the poles. Accordingly the number of miles in a degree of longitude decreases as the latitude increases. Secondly, all the meridians are circles of the same size, while the parallels of latitude decrease in circumference as we go from the Equator toward the poles.

Day and Night

Sec. 15. If a globe is held at some distance from a lamp in a darkened room, it will be seen that one half of the globe is illuminated by the light, while the other half is in the shadow. If a spot is marked on the darker side of the globe, and the latter is rotated slowly, the spot comes in time to a point where it receives

the direct light of the lamp, and if the globe is further rotated, the spot moves across the rest of the illuminated field and then passes into the shadowed half again. Somewhat similar are the relations between the sun and the earth. The former gives out intense light and brightly illuminates one half of the surface of the earth, but leaves the other half in darkness. As the earth rotates, the places on it move across the region of darkness and then across

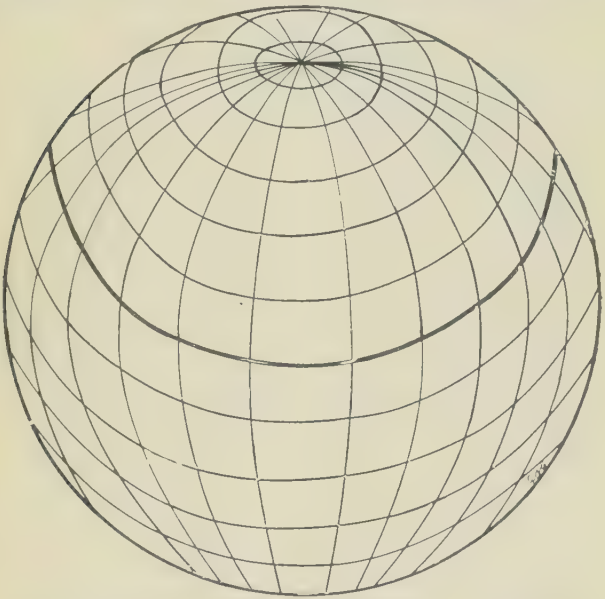


FIG. 10. SHOWING PARALLELS OF LATITUDE AND MERIDIANS

the region of light. While a place is in darkness it is night there, and while a place is in light it is daylight there. The time at which it passes from the dark to the illuminated half is called *sunrise* and the time at which it passes from the illuminated to the dark half is called *sunset*. Fig. 11 shows the sun and the earth as they would appear if one looked at them from above the north pole. The large arrow shows the direction in which the earth is turning. The line from A to C divides the illuminated half of the earth from the dark half. The lines from the sun to the earth represent the rays of light. The part of the earth at A is just passing from darkness to

daylight, hence it is sunrise at this place; at C it is sunset, since this place is passing from daylight to darkness. At B, midway between these two points, it is noon.

Measurement of Time

Sec. 16.—It will be seen from Fig. 11 that while at B it is noon, at D, which is a little to the west of B, it is not quite noon, while at E, a little to the east of B, it is past noon. While at A it is sunrise,

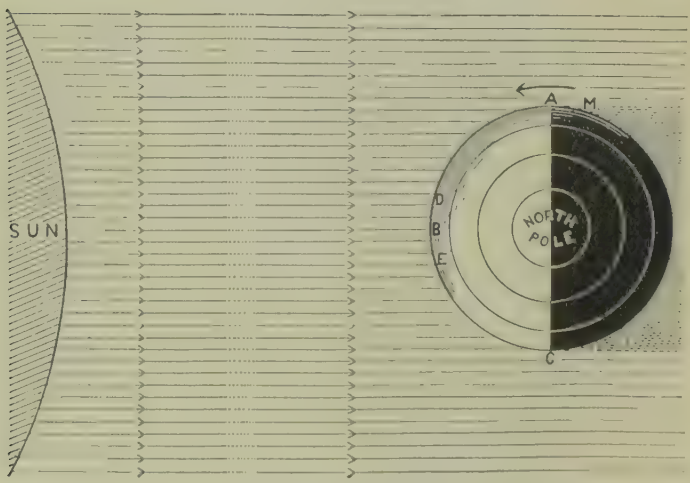


FIG. 11. SHOWING THE CAUSE OF DAY AND NIGHT

at M it is a little earlier than sunrise. If people at D, B, and E set their watches by the sun, at B the watch would register 12 o'clock noon; at D 11.45 a.m. (say); and at E 12.15 p.m. Suppose D to be Montreal, B to be Three Rivers, and E to be Quebec, the watches and clocks in each of these three cities would show different times. If a citizen of Montreal went to Three Rivers he would have to set his watch forward fifteen minutes, and if he went to Quebec he would have to set it forward another fifteen minutes. When he returned he would have to set it back by the same amount as he passed through these places. It is easy to see that if each place took its time from the sun, or kept *solar time*, as it is called, there would be great confusion in travelling and in many other ways. To avoid this it has been decided to have the same time over a

FIG. 12. STANDARD TIME BELTS

The figures in circles indicate the number of hours faster or slower than Greenwich time. The dials along the bottom indicate the time in each belt when it is 12 o'clock at Greenwich. The heavy dotted line along the left is the international date line. The names of the time belts passing through Canada are given on the dials at the bottom.

wide area, and then to change it by a whole hour in the adjoining area. Since every point on the earth makes a complete circuit in twenty-four hours, its whole surface is divided into twenty-four sections, each measuring fifteen degrees of longitude in width. In each of these sections the time is an hour earlier than that of the section directly east of it. Such time is called *standard time*, and it is now adopted very generally in all parts of Canada and the United States. Fig. 12 shows the belts in these two countries as well as in the rest of the world. It will be noticed that in practice the belts are very irregular and not strictly within the meridians of fifteen degrees as defined above. The map also shows the names selected to distinguish the time in each belt in Canada and the United States. It is interesting to know that this system of standard time was first advocated by Sir Sanford Fleming, an eminent Canadian.

Revolution of the Earth

Sec. 17. The apparent motions of the sun.—The sun does not follow the same course across the sky from day to day; in fact the track followed each day is different from that of the day before or the day after. In a single day the change is not great, but in a few months it becomes very marked. Fig. 13 represents the course followed on 21st June, 22nd September, 22nd December, and 21st March respectively in the latitude of Southern Canada. The horizontal circle shaded within represents the horizon of an observer stationed at its centre. The directions are indicated. On 21st June the sun rises in the north-east, ascends until noon, when it is almost overhead, then descends, and finally sets in the north-west. Much more than one half of its circuit is made above the horizon. Accordingly, we have much more than twelve hours' sunshine on this day. On 22nd June, the following day, it follows a course parallel to its path of 21st June, and a little to the south of this path. By 22nd September it reaches the second position represented in the figure. Here it rises directly in the east and sets directly in the west. As it makes one half of its circuit above the horizon, we have exactly twelve hours of sunshine and twelve hours of darkness. By 22nd December it has reached the third position represented in the figure. It now rises far to the south of east, sets far to the south of west, and makes much less than one half of its circuit above the horizon. Accordingly, there will be much less than twelve hours of sunshine on this day. After 22nd December it returns on its course and it reaches the September position again on 21st March. The time at which the sun's daily course is farthest

north—namely 21st June—is called the *summer solstice;* the time at which it is farthest south—namely 22nd December—the *winter solstice.* The times at which it is midway between these positions—namely 21st March and 22nd September—are called respectively the *spring equinox* and *autumn equinox.* The name equinox means in Latin "equal night," and refers to the fact that

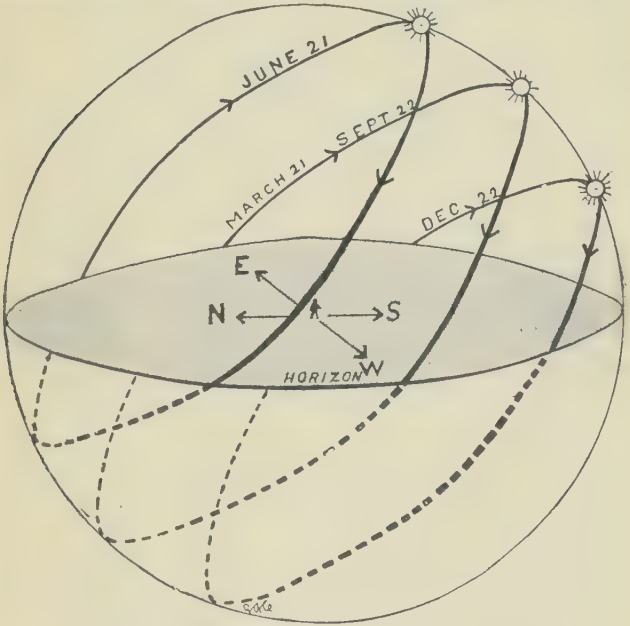


FIG. 13. THE PATH OF THE SUN ACROSS THE SKY

on this day, the day and night are of equal length, viz. twelve hours each.

Sec. 18. Explanation of the seasons.—We have two opposite seasons, winter and summer. Spring and autumn are seasons of change from winter to summer and from summer to winter respectively. The difference between the course of the sun in winter and summer is the cause of all the difference between these two seasons. We derive practically all our heat from the sun. Since the sun shines on a summer day for as many as fifteen hours in Southern Canada, while on a winter day it shines for little more than nine

hours, it will be readily seen that we must receive much more heat from the sun during a summer day than during a winter day. Again, during the summer the sun is higher in the sky through the greater part of its course than it is during the winter. A higher sun sends down rays more nearly vertical, and these rays have a greater warming effect. This is readily shown. In the winter the snow on the southern slope of a roof melts much more quickly than that on the ground. This is because the rays of the sun strike the snow on the roof almost, if not quite, perpendicularly, while they strike the snow on the ground slantingly (Sec. 47). It is partly for the same reason that the sun's rays feel so much warmer at noon than just after sunrise or just before sunset. For the two reasons just stated—namely, the long days and the nearly vertical

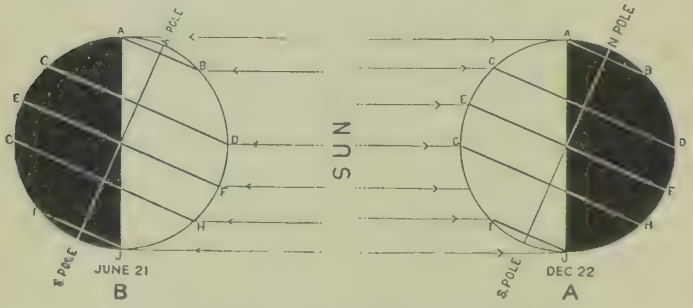


FIG. 14. SHOWING THE EARTH'S POSITION IN RELATION TO THE SUN ON 21ST JUNE (TO THE LEFT) AND ON 22ND DECEMBER (TO THE RIGHT)

rays—heat accumulates during the summer, and the weather becomes very warm. But during the winter, since we are receiving so little heat from the sun, more heat is lost during the night than is gained during the daylight, and the days become colder.

Sec. 19. The revolution of the earth.—The question naturally arises, why does the sun change its path from day to day? It is hard to give an answer to this question that will be readily understood by boys and girls, but the following facts may help you. The earth has a motion that we have not mentioned yet. Besides its spinning round on its axis, it also moves bodily round the sun. Imagine a ball, which represents the sun, to be floating at the centre of a smooth, circular lake. Another smaller ball floating near the margin represents the earth. Picture the earth floating around the sun almost in a circle, a complete circuit being made in one year. If the ball representing the earth had been soaked in red ink before putting it in the water, it would have marked out

in red the path it followed. The path of the earth round the sun is called the *earth's orbit*. This path is elliptical, that is to say it forms the regular curved figure known as an ellipse, but the ellipse of the earth's orbit is very nearly a circle.

Next let us suppose that the ball representing the earth is spinning around on its axis as it floats around the ball representing the sun. Now suppose that the axis on which the ball rotates is not vertical but oblique in relation to the surface of the water. The earth's axis is similarly oblique and all our changes of seasons depend on this inclination. Moreover, the direction in which the axis points never changes as the earth moves around the sun, but remains nearly in line with the pole-star. Fig. 14 shows the earth at two different positions on opposite sides of the sun. B illustrates its position on 21st June, with its axis leaning toward the sun ; in A is shown its position on 22nd December, the axis leaning away from the sun. The arrows represent the sun's rays. The shaded part of the circle representing the earth indicates the half that is in darkness, the unshaded part the half that is illuminated by the sun. Consider a place E at the Equator on 22nd December. The sun shines slantingly on it, and since EF is half in light and half in darkness, during a rotation of the earth any point on the Equator is for twelve hours in sunshine and for the other twelve hours in darkness. At C the sun shines still more slantingly, and since less than half of the circle CD is in light, there will be sunshine for less than twelve hours during the day. Consider the same place on 21st June. Now more than half of the circle CD is within the illuminated area, and during a rotation of the earth there will be more than twelve hours of sunshine. Moreover, the sun is now shining straight down on D. Evidently there will be summer along the circle CD on 21st June and winter on 22nd December. It can be readily seen that the same will be true of all points north of the Equator, and the farther north the position, the greater number of hours of sunshine on each day in summer and the fewer in winter. South of the Equator the conditions are reversed. All parts have winter on 21st June because there are short days and slanting sunlight, and have summer on 22nd December because there are longer days and a more nearly vertical sun. On 22nd December the cap around the north pole bounded by the circle AB is entirely outside the area of illumination, and during the rotation of the earth on this day no place on this cap receives any sunshine. On 21st June this same region is entirely within the area of illumination and there will be twenty-four hours' sunshine. Opposite conditions occur on the south polar cap, where there are twenty-four hours of darkness on 21st June, and an equal period of sunshine on 22nd December. On 21st June

and 22nd December these polar caps are of greatest extent, when their boundaries reach $23\frac{1}{2}$ degrees away from the poles. The circles bounding them when they are at their greatest extent are called *polar circles*. The circle around the northern cap is also called the *Arctic circle* and the one around the southern cap the *Antarctic circle*. The lines CD and GH, which represent the circles farthest

FIG. 15. FOUR POSITIONS OF THE EARTH AS IT REVOLVES ABOUT THE SUN

north and south over which the sun shines vertically, are called the *tropics*. The northern is the *tropic of Cancer*, the southern the *tropic of Capricorn*.

Fig. 15 shows four positions of the earth as it revolves around the sun. The earth is viewed from near the pole-star. It is quite clear from the drawing that on 21st June the whole region within the Arctic circle is within the illuminated part of the earth's surface, and that as the earth rotates every point within the cap

will receive sunshine for twenty-four hours on this day. Three months later, 22nd September, this same region is half within the illuminated area and half within the dark area. Accordingly, every point within it will have equal day and night. The conditions on 22nd December and on 21st March can be worked out by the pupil for himself.

Sec. 20. The zones of light.—The belt (Fig. 16) between the

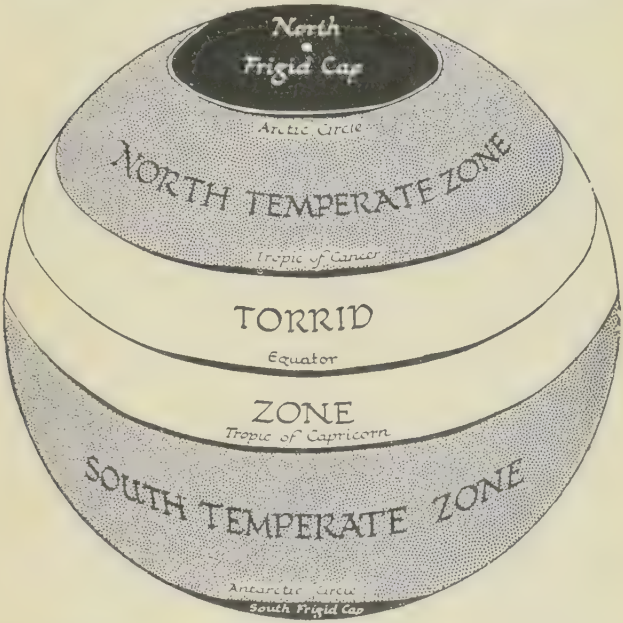


FIG. 16. THE ZONES

two tropics is called the *torrid zone*. It is a region with a nearly vertical sun at all times of the year: consequently the temperature is high. The days and nights are never very unequal in length. The belt between the tropic of Cancer and the Arctic circle is called the *north temperate zone*, and the belt between the tropic of Capricorn and the Antarctic circle is called the *south temperate zone*. The temperate zones are cooler than the torrid zone, and have greater differences between the lengths of day and night, and between the temperatures of summer and winter. The cap

between the Arctic circle and the north pole is called the *north frigid zone*. The corresponding cap around the south pole is called the *south frigid zone*. The frigid zones are the coldest of all. They have sunlight for the whole twenty-four hours of the day during part of the summer, and complete darkness for the whole twenty-four hours of the day during part of the winter.

Questions

1. The position of Quebec is about 47 degrees north latitude and 71 degrees west longitude. Explain what this statement means.
2. The tropics are $23\frac{1}{2}$ degrees north and south of the Equator. How many miles wide is the torrid zone? (Sec. 13.)
3. The Arctic and Antarctic circles are $23\frac{1}{2}$ degrees from the north and south poles respectively. How many degrees are they from the tropics? How many from the Equator? How many miles wide is the temperate zone? (Sec. 13.)
4. Why is one able to see farther from the mast-head of a ship than from the deck?
5. June 21st is the longest day, yet August is usually the hottest month. Explain why this is so.

CHAPTER II

THE ATMOSPHERE

Projects

Sec. 21. To make and study a record of the weather for at least one month.—In your note-book make a table with the following headings :—

Date.	Temperature.	Wind.		Sky.	Precipitation.	Remarks.
		Direction.	Strength.			

Every evening make an entry under each of these headings. Observe the direction of the wind from the smoke coming out of the chimney. Use the following terms to describe the force of the wind : (1) *light,* just moving the leaves of trees ; (2) *moderate,* moving branches ; (3) *brisk,* swaying branches, blowing up dust ; (4) *high,* swaying whole trees ; (5) *gale,* breaking small branches. Insert *calm* when there is no wind. By studying your month's record find answers to the following questions : How many clear days were there? What was the direction of the wind on the clear days? How many cold days were there? Was the sky usually clear or cloudy on the cold days? What was the direction of the wind on the cold days? How many rainy days were there? What was the direction of the wind during the rainy days? What kind of weather usually followed the rainy days?

Sec. 22. To study the formation of dew and frost.—Every evening for one month observe whether the sky is clear or cloudy, and whether it is windy or calm. Each morning observe if there is dew, and whether it is abundant or light. What relation is there between the formation of dew and the state of the sky and wind

on the previous evening? Some morning when there is a heavy dew, observe on what kinds of objects it gathers most abundantly. Is it found on grass? On leaves of plants in the garden? On the ground? On the leaves of trees? Is it more abundant on the grass in the meadow or on the grass in the shade of a tree? Is it found on wood, stones, or the dust of the road? During October and November make similar observations with regard to frost.

Sec. 23. To study the condensation and evaporation of water.—(*a*) On a humid day put some water of living-room temperature in a polished tin vessel. Dry the outside thoroughly. Gradually add to the vessel cold water or ice and stir the water steadily. Observe the first appearance of a film on the polished outer surface. Take the temperature of the water with a thermometer at the time when the film first appears. Repeat the experiment in order to observe if the film always appears at the same temperature. Repeat the experiment, only let the tin vessel, half filled with water, stand in the shade for half an hour. What is found on the outside of the vessel after it has stood for half an hour? Where did this liquid come from? Name other objects that "sweat" on a humid day.

(*b*) On a cold day heat water on a stove until it is almost boiling, then quickly place the vessel at an open window. What appears above the vessel of water? Where did it come from?

(*c*) Into an automatic sprayer, such as farmers use for spraying potatoes, pour several inches of water, then by means of the pump compress the air within it. After it has stood for ten minutes, let the air out of it suddenly and look through the opening at the air within. What caused the cloud to form? Has the sudden expansion of the air made it warmer or colder?

(*d*) Move the handle of a bicycle pump up and down twenty times without attaching the pump to a tire. Feel the bottom of the barrel and the rubber connecting-tube to find out whether they have become warmer. Next connect the pump with the tire and work it twenty times as before. In which case does the barrel and the connecting tube become warm? Is there friction in each case? Is the heating caused by friction? How does the air change in volume in the second case? When air is compressed, what change takes place in its volume?

Sec. 24. To study wind and rainfall maps of the world.—Answer the following questions from information obtained by studying Maps 3 and 4 in the Atlas: What do the thin arrows signify? The thick arrows? The long arrows? The short arrows? Where do the most constant winds blow? What name is given to these winds in the Atlantic, Pacific, and Southern Indian Oceans? In

[*Courtesy of United States Weather Bureau.*

FIG. 17. DESTRUCTION CAUSED BY A TORNADO ON 26TH MAY, 1917

What is its effect on the trees? Notice that the bark has been stripped from the lower part of the middle tree.

what directions do they blow? Which of these winds brought Columbus to America? What is the name of the region lying between the trade-winds blowing from the north and those blowing from the south? Do these winds blow from a colder to a warmer region or from a warmer to a colder region? Will they become warmer or colder as they approach the Equator? Will such winds blowing over a level surface be drying winds or winds producing rain? (Sec. 37.) What difference in position do the doldrums occupy in January and in July? Explain the reason for the difference (Sec. 36). Are the winds in the temperate zone more generally from the east or from the west? What name is given to these winds in each of the oceans? Are they more regular in the north temperate or in the south temperate zone? Why? (Sec. 39.) What name is given to the regions between the trade-winds and the westerlies? Are the westerlies stronger in winter or in summer? Will winds blowing away from the Equator, such as the westerlies in the North Atlantic Ocean, become warmer or colder as they advance? Will they be drying winds or winds from which rain is likely to come? Why does Western North America receive more rain in winter than in summer? Why does Southern Chile receive heavy rainfall during both summer and winter? In the temperate zone do the east or the west sides of the continents receive more rain? Why? Which sides of the continents in the torrid zone receive more rain? Why? In summer and in winter what are the directions of the winds in the Northern Indian Ocean and over Southeastern Asia? What are the directions over Northern Australia? What name is given to the winds blowing in these regions? Explain the influence of the directions of these winds on the amounts of rainfall that occur in India and Northern Australia in January and in July.

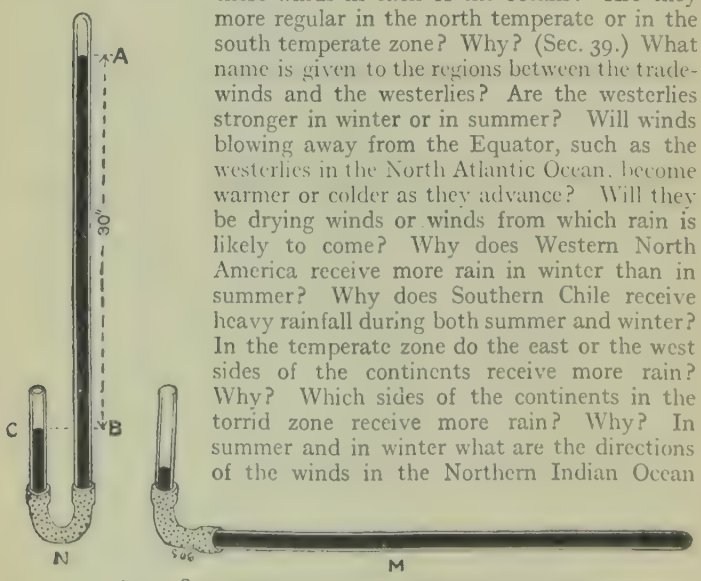
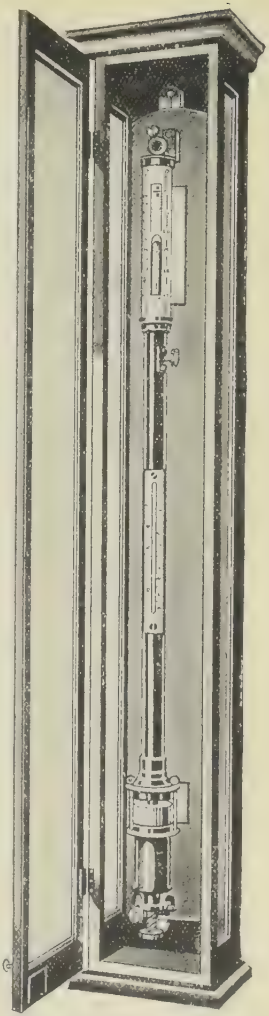


FIG. 18. SHOWING HOW A BAROMETER IS MADE
The mercury is here shown black, the rubber tubing spotted.

Sec. 25. Warming the air.—The sunlight passes through the air without heating it to any considerable extent. But as soon as the sunlight strikes the earth, it at once begins to heat the ground. As the earth becomes warm, it gives off part of its heat to the air in contact with it. Thus the air is warmed from below upward. This is the chief reason why the upper air is much colder than the air near the surface of the earth.

Sec. 26. Heating of land and water.—The sunlight warms the land much more quickly than it does the water. There are several reasons for this difference. As the water is transparent, the sunlight penetrates it for a considerable depth, consequently the heat is distributed through so thick a layer that the whole mass is only slightly warmed. On the other hand the sunlight gives its heat only to a very thin layer of earth and is thus able to warm it up to a much higher temperature. Again, it takes much more heat to raise the temperature of water through one degree than to raise the temperature of earth through the same range. Accordingly the water is always slower than the land in changing its temperature. It is warmed more slowly than the land during the spring and summer and is cooled more slowly than the land during the autumn and winter. Therefore in summer the land is on the average warmer than the adjacent water, and in winter it is colder.

Sec. 27. The pressure of the air.—The air seems to possess so little substance that, as we move through



[*From catalogue of Philip Harris, Birmingham.*

FIG. 19. A MERCURY BAROMETER

it, its presence is hardly felt. Yet we can easily prove that it has weight just like water or rock. If a large vessel filled with air is weighed, and the air is then drawn from it, the weight becomes considerably less. The force of the air also becomes very marked when a strong wind is blowing, for then it is capable of tearing down stout trees or strong houses made of brick and stone (Fig. 17). A cubic foot of air weighs only a little over an ounce, but as the atmosphere extends to a great height, the total weight of the air pressing down on even a small surface of the earth is very great.

The instrument used to measure the pressure of the air is called the *barometer*. There are several kinds of barometers, the most accurate being the mercury barometer. This in its simplest form consists of a long glass tube sealed at one end and joined by a rubber connection to a shorter glass tube (Fig. 18). Mercury is poured into the two tubes while they are in the position shown in M and then the closed tube is brought into the position shown in N. The mercury sinks down the long tube so as to leave an empty space above A. The air pressing down at C is just balanced by the weight of the column of mercury AB. As this column of mercury is about thirty inches high, we say that the pressure of the air is thirty inches. A column of mercury thirty inches high and one square inch across weighs about fifteen pounds. Accordingly the pressure exerted by the air on all bodies near the surface of the earth is about fifteen pounds on every square inch or about one ton per square foot. As one ascends the pressure becomes less, since there is not so much air to exert pressure. On high mountains the mercury in the barometer may drop to one half of its height at the surface of the earth.

Fig. 19 (p. 27) shows a more perfect mercury barometer, enclosed in a glass case with the door open.

Water in the Air

Sec. 28. Evaporation and condensation. If a small lump of sugar is dropped into a glass of water, it becomes gradually smaller and finally disappears. If another lump is added, it disappears more slowly, and if other lumps are added, a condition is soon reached in which no more sugar will disappear no matter how long it remains in the water. We say the sugar *dissolves* in the water, and when the liquid can dissolve no more sugar it is said to be

saturated. In a similar way, if water is left in contact with air, the former dissolves in the latter. When water passes into the air, we usually say it *evaporates* instead of dissolves, but both words have the same significance. The dissolved or evaporated water is invisible and is called *water vapour*. Clothes dry and the level of ponds is lowered because the water dissolves or evaporates into the air. Again, just as water becomes saturated with sugar, so air becomes saturated with water. If a saturated solution of sugar is cooled, usually it can no longer contain all the dissolved sugar, and little grains of sugar settle down through the solution, forming a cloud. In a similar way when saturated air is cooled, little drops of water appear scattered through its mass forming a *cloud* or *fog* as the case may be. The formation of water-drops in moist air owing to its cooling below its saturation temperature is called *condensation*, and the water is said to *condense* out of the air. If saturated air is warmed, it is no longer saturated but is capable of dissolving more water. On the other hand, if unsaturated air is steadily cooled, it becomes saturated sooner or later.

Sec. 29. Cause of the formation of clouds.—A cloud is composed of little globules of water or crystals of ice, which float high in the air. Any process that cools air, if allowed to act steadily, will in time bring it down to its saturation temperature and produce a cloud. We might wonder what cooling process could be taking place high up in the air, where clouds usually form. For instance, if a mass of moist air were blown against the side or top of a cold mountain, it might easily be chilled below its saturation temperature and a cloud would result. But this could occur only in mountainous districts, and clouds are abundant over plains. Warm air may be cooled by mixing with cold air, but such mixing probably does not take place on a large scale. For when a mass of air is blown into a certain region, it usually does not mix to any great extent with the air that was formerly there, but pushes the mass before it and thus replaces it. Therefore mixing accounts for only a very small amount of cloud formation. The most common cause of the formation of clouds is rather hard to explain. When air is compressed, as in a bicycle tire, it becomes warmer, and when it expands, as when the air suddenly escapes from a bicycle tire, it becomes cooler. Air rises to higher levels either because it is in an ascending air current or because it is tilted up the side of a mountain. In both cases it is reaching regions where there is less air above it and consequently a steadily decreasing pressure. Whenever the pressure on a mass of air becomes less the air expands. Therefore as air rises it steadily expands and as it expands it becomes cooler. Consequently the higher the ascent the cooler

the air becomes. Air that is steadily ascending, therefore, is sure in time to reach its saturation temperature, when condensation occurs, and a cloud is formed. The beautiful masses of white, rolling clouds (Fig. 20), so commonly seen in the sky on summer afternoons, are always formed in this way. As air descends, the changes occur in a reverse order. The pressure on the air increases, it becomes compressed and warmed, and if there were clouds in it at higher levels, they are likely to be dissolved in the warm air and to disappear, leaving a clear sky. If a moist wind blows against the side of a mountain, the air, as it moves up the side, usually becomes cloudy and produces rain, and as it descends on the opposite side, becomes warm and dry. Accordingly any wind blowing from the sea against rising land is likely to produce clouds and rain.

Sec. 30. Fog.—When moist air comes in contact either with cold water or land, it becomes cooled, and condensation may occur, in which case a *fog* or *mist* is formed. Very often in the spring of the year warm moist winds from the south, blowing over Central Canada, then covered with snow, become chilled in their lower layers below the saturation temperature, and a fog is formed. Again, in late summer and autumn after a day during which the air has become warm and has dissolved much moisture, there may be rapid cooling until the lower layer becomes chilled below its saturation temperature. Then a fog occurs, which is most dense at sunrise (Fig. 21). As the hot sun warms the air, the fog disappears.

Fogs over the water are very dangerous to ships on our lakes and rivers. The greatest shipping disaster in Canada within recent times was due to a fog in which the *Empress of Ireland* collided with another ship in the Lower St. Lawrence, and hundreds of lives were lost.

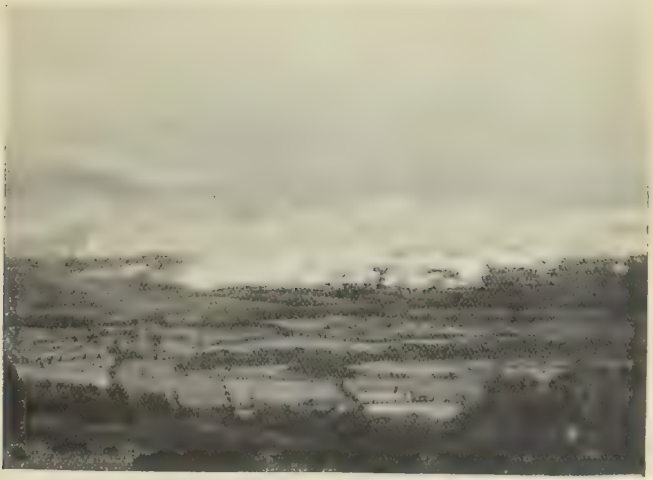
Sec. 31. Rain and snow.—The globules of water forming a cloud are so small that the air currents hold up the cloud in the air. As the air in a cloud becomes still cooler, more water condenses on the surface of the globules, and they become heavier. As they move about, two often come together and unite to form a single globule. As the globules increase in size, they begin to settle down and finally fall to the earth as drops of rain.

The condensed moisture in a cloud may consist not of globules of water but of ice-crystals. This is always the case when the temperature of the cloud is below freezing-point. Then, as further condensation occurs, the ice particles are built up in a regular way to form crystals (Fig. 22). These, on account of their increased weight, sink to the surface as snow-flakes.

[*Courtesy of Prof. G. A. Clarke, Meteorological Office, Aberdeen.*

FIG. 20. CUMULUS CLOUD

Notice the rolling tops and horizontal bases.



[*Courtesy of United States Weather Bureau.*

FIG. 21 A RISING FOG

Rain and snow are of the very greatest importance to man. All vegetable growth depends on rainfall. Hence, where rain is absent, there is usually no vegetation, and the region is a desert. Rain also purifies the air, and by supplying water for all rivers and lakes,

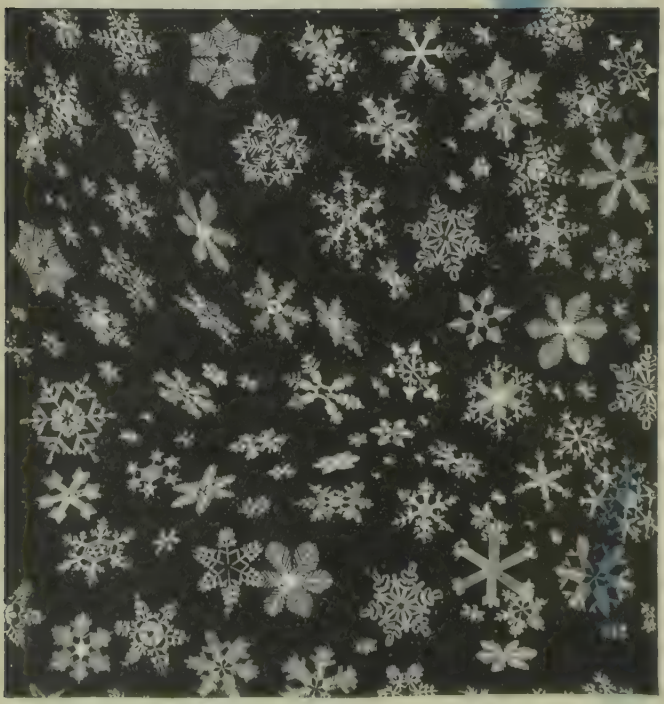


FIG. 22. WHITE JEWELS THAT FALL FROM THE SKY

The most dreary scene looks beautiful when covered with a mantle of snow, but it is not only thus that the snow is beautiful. If the newly-fallen flakes are examined through a magnifying glass, they are seen to be made of delicate crystals arranged in star-like forms as here. It is rarely, however, that more than one or two of these forms fall at one time. When the flakes get knocked together, they lose these dainty shapes.

contributes much to transportation. Snow, besides protecting plants from the cold of winter, is of great assistance to transportation in many parts of Canada. This is especially true of the woods of the North, where in the winter snow-roads can be made over

the roughest ground and the logs easily transported from the deep woods to the river bank.

Sec. 32. Dew and frost.—The outside of a metal pail of iced water on a humid day becomes covered with a film of moisture, which soon gets so thick that it runs down in drops. The formation of this film is due to the fact that the cold pail chills the air in contact with it below its saturation temperature and thus causes the water in the air to condense on its surface. After sunset the grass and other objects lose their heat by emitting it into space, and in time they may become cooled below the saturation temperature. Then moisture condenses on their surface, and these little particles of moisture run together to form dewdrops. If the saturation temperature is below freezing-point, the moisture condenses on the surface as ice-crystals. It is then called *frost*. If the sky is cloudy, the objects are not able to send off their heat into space, since the cloud acts as a blanket, and they do not become cooled so rapidly. Accordingly, on cloudy nights there is not likely to be dew or frost.

Dew is of great benefit to vegetation, since during dry weather it is the only source of water for plants. Frosts are the cause of very great damage to Canadian crops almost every year. So serious is the danger that the times of planting and harvesting almost all the crops are largely determined by the times of the earliest and latest killing frosts.

Winds

Sec. 33. Cause of winds.—If a small flame is placed under a vessel of water (Fig. 23), currents are produced in the directions indicated by the arrows in C. The causes are as follows. The water directly above the flame becomes heated first. As it expands, the surface becomes heaped up (B). At once the water that is heaped up flows off toward the margin as indicated by the arrows in B. There is now more water above MM than above N. Accordingly the pressure at MM is greater than at N, and the water at MM is forced in under the water at N, and consequently the water at N is forced up. Thus the water circulates as indicated by the arrows in C.

Similar motions take place in the atmosphere. If a mass of air near the surface of the earth is heated, it expands. The air above it is forced up, and some of it overflows (Fig. 24). The amount of air above NN is thus increased, and above M it is decreased. Hence the pressure at NN will be greater than at M, and a surface current will push in from NN toward M.

Sec. 34. High and low pressure.—In the preceding section it is shown that whenever the air in a region becomes heated above the air in surrounding regions its pressure becomes less than that of

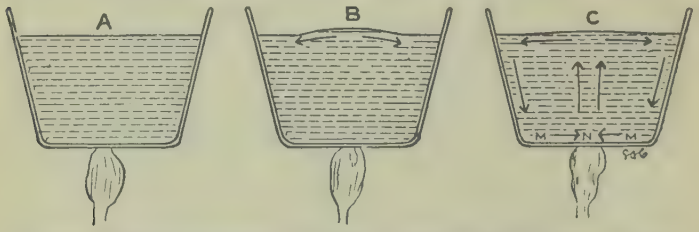


FIG. 23. CIRCULATION IN A DISH OF WATER HEATED BY A FLAME

the surrounding regions. Such a region is called a *low*. A region in which the pressure is higher than in surrounding regions is called a *high*. Winds always blow along the surface of the earth from highs to lows, and upper air currents blow from lows to highs. The

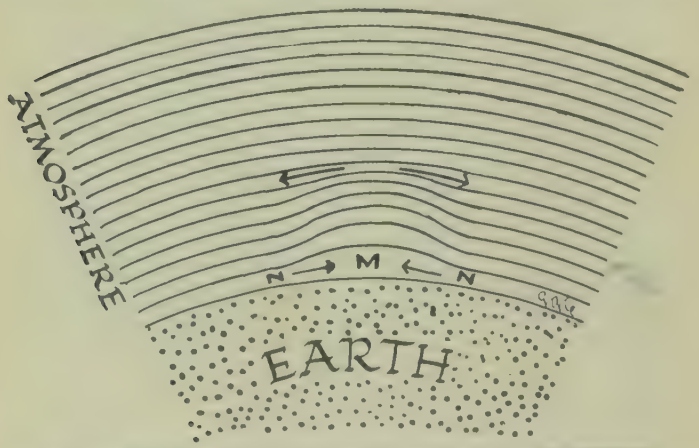


FIG. 24. DIAGRAMMATIC SECTION OF EARTH AND ATMOSPHERE

The parallel lines represent the successive layers of the atmosphere. At M the lower air is heated, which causes its expansion.

air toward the centre of a high has a downward motion, while the air toward the centre of a low has an upward motion.

Sec. 35. Isobars and isobaric maps.—Many observers in various

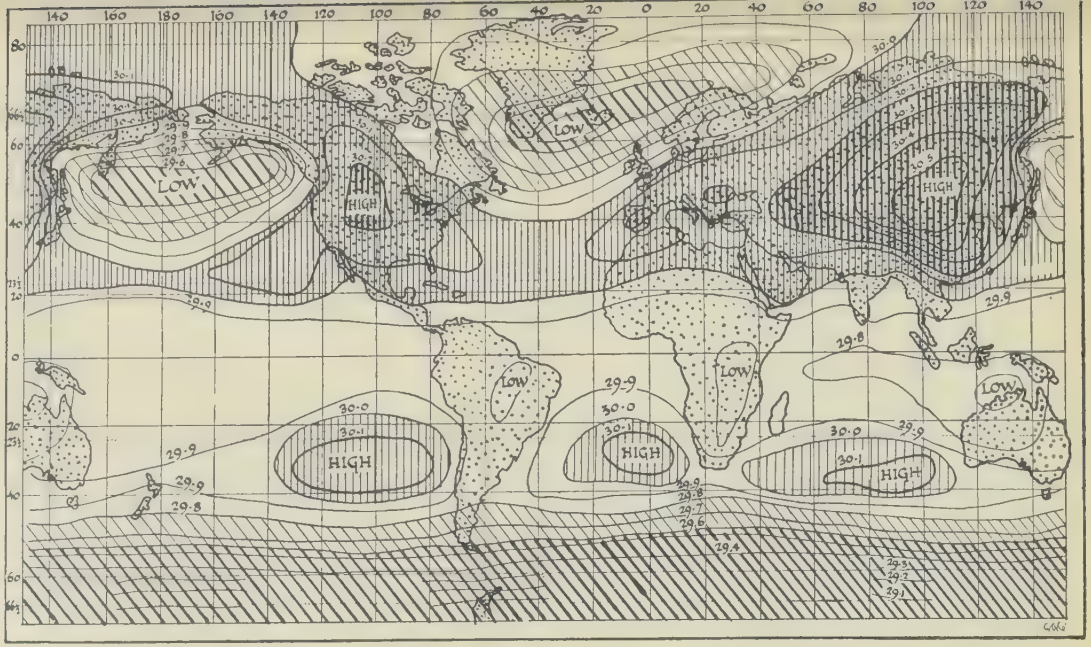


FIG. 25. ISOBARS FOR JANUARY

High pressures are represented by vertical lines, low pressures by oblique lines.

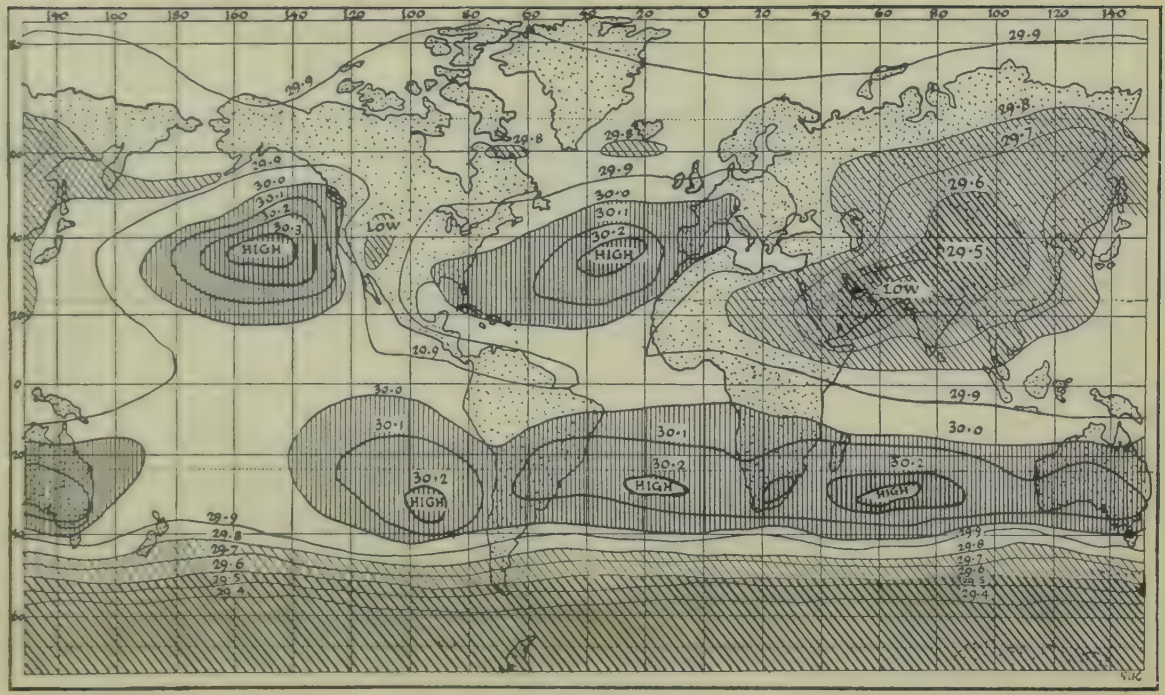


FIG. 26. ISOBARS FOR JULY

High pressures are represented by vertical lines, low pressures by oblique lines.

countries make measurements of the air pressure every day, and many sea captains make similar measurements on the seas. These records have been preserved, and the average daily, monthly, and yearly pressures are calculated from these data. If the numbers representing the pressures are put on a map, and lines are drawn through all places having the same pressure, these lines are called *isobars* and the map an *isobaric map*. Figs. 25 and 26 show the isobars of the world for January and July. It will be observed from these maps that the Equatorial belt has low pressure in both January and July and that belts in the region of thirty degrees have high pressure, although this is not so continuous as the low

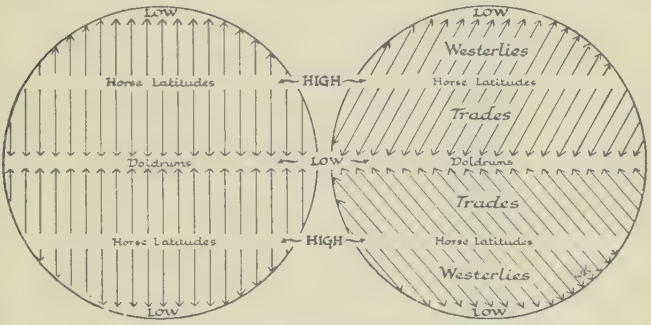


FIG. 27. DIAGRAMMATIC REPRESENTATION OF THE CHIEF WINDS AND BELTS OF CALMS OF THE EARTH

The figure on the left shows the direction the winds would take if the earth did not rotate; the figure on the right shows the deflecting effect of the earth's rotation.

pressure near the Equator. Beyond the high belts pressures decrease toward the polar circles, though this decrease is more regular in the south than in the north.

Sec. 36. Chief winds of the earth. - Fig. 27 shows diagrammatically the distribution of highs and lows on the surface of the earth, and the arrows in the left hand figure indicate the directions in which the winds would blow if they moved directly from highs to lows. But it has been learned that the rotation of the earth has an effect on the directions of winds. If a drop of paint is put on a stationary globe standing on a vertical axis, it will flow directly down its surface in the direction of the line A in Fig. 28. But if the globe is rotating in the direction of the large arrow the paint will flow along the path B. The rotation causes it to be deflected to the west north of the Equator and to the east south of the Equator.

Now the rotation of the earth deflects the winds in quite a similar way. All winds north of the Equator, no matter in what direction they start, are deflected to the right, and all winds south of the Equator are deflected to the left. The arrows on the circle to the right of Fig. 27 represent the real direction in which the winds blow, the deflection indicated being due to the earth's rotation.

FIG. 28. THE EFFECT OF THE ROTATION OF A GLOBE ON THE DIRECTION OF FLOW OF A LIQUID ON ITS SURFACE

Those on each side of the Equator are called the *trade winds*, those beyond thirty degrees are called *westerlies*. Of course these winds are not so regular as they are represented in the figure. The large masses of the continents have a marked effect on the winds and cause many irregularities (Secs. 41 and 42). Moreover, all these belts follow the sun as it moves north and south of the Equator. Maps 3 and 4 in the Atlas show more accurately the position, direction, and force of the winds.

Sec. 37. The trade-winds.—The trade-winds on the ocean are the steadiest in the world. They blow for many days in the same direction. When ocean traffic depended on sailing vessels the trade-wind belts were very important transportation areas. On the land the trade-winds are not so regular. They have, however, a marked effect on the climate of tropical countries. As they blow toward the Equator, they become warmer, and consequently they are drying winds. Therefore, whenever they blow over level plains, they lick up every trace of moisture, scarcely any rain falls, and the region is desert. Almost all the great deserts of the world lie in the trade-wind belt (Map 7 in Atlas). Where they blow against land sloping upward, they ascend, the air becomes chilled, and heavy rains fall, and since the trades are constant winds, heavy rains may occur in such sloping regions almost every day in which the trade-winds blow.

Sec. 38. The doldrums.—In the region between the trade-winds the prevalent direction of the air is upward. This belt, which encircles the earth, is called the *doldrums*. As there is little motion of air along the surface, it is a region of calm, and the ascending current of air produces much cloudiness and rain (Secs. 29 and 30). The leaden sky, the murky, sultry air, and the furious thunderstorms, that occur almost every afternoon, make the doldrums one of the least attractive parts of the world in which to live.

Sec. 39. The westerly winds.—The westerly winds are much less regular than the trades, especially in the Northern hemisphere, where the large bodies of land have a disturbing influence. Since Canada is within the region of the westerlies, our prevailing winds are from the west, north-west, and south-west.

Sec. 40. The horse-latitudes.—Since winds are blowing out in both directions from the region that lies between the westerlies and the trade-winds, air must continually descend in this region. As descending currents become warmer and drier (Sec. 29) this region has clear skies and dry, invigorating air. As there is little lateral motion of the air it is a region of calms. These tracts in the Atlantic Ocean are called the *horse-latitudes*, and the same name is often given to the corresponding regions in the other oceans (Maps 3 and 4 in Atlas).

Sec. 41. Land and sea-breezes.—During the day the land rapidly becomes warm if the sky is clear, but an adjacent body of water changes its temperature very slowly (Sec. 26). Again, at night the land loses its heat very quickly, but the water does not. Consequently during the day the pressure over the heated land is less than over the cooler water, and winds blow toward the land, while during the night the cool land has a higher pressure than the sea,

and winds blow from the land to the sea. On islands and along sea coasts these winds blow very regularly throughout the year. The day-breeze blowing from the water is called the *sea-breeze*. It is this cool breeze that makes the seaside so attractive during the summer. The night breeze blowing from the land is called the *land-breeze*. The fisherman makes use of both these breezes. In the early morning he puts out to sea with the land-breeze filling the sails of his fishing smack, and in the afternoon he returns with the help of the sea-breeze.

Sec. 42. Monsoon winds.—In summer the land is warmer than the sea, and in winter the sea is warmer than the land (Sec. 26). Accordingly lows are found over the continents during the summer and over the oceans during the winter (Figs. 25 and 26). Winds will, therefore, tend to blow toward the continents during the summer and away from them during the winter. For this reason even the trade-winds and the westerlies are deflected from their regular courses as they approach the continents. Eurasia, the most massive of the land divisions, has the most marked effect on the winds blowing over India and South-eastern Asia (Maps 3 and 4 in Atlas). During the winter they blow out from Central Asia over India, Burma, and South China, but in the summer they blow in the opposite direction. Australia has a similar effect on the winds to the north of it. During its summer (December to February) the winds blow toward it from the north, and during its winter (June to August) they blow in the opposite direction. Such winds blowing from one direction during one season and from the opposite direction during the opposite season are called *monsoons*. When we study India, we shall see that these winds have a marked effect on its climate. A study of Maps 3 and 4 in the Atlas will show that similar winds blow on the Pacific coast of South Mexico and Central America, on the United States coast of the Gulf of Mexico, and on the coast of Sierra Leone in West Africa.

Weather

Sec. 43. The Meteorological Service.—Everybody is interested in the weather. In fact we regulate our lives to a great extent by it. All workers recognise the importance of knowing in advance what the weather is going to be like. Captains of ships wait to receive the weather forecast before they decide whether to continue their journey or to remain in port; farmers look anxiously to see whether there is likely to be frost, and all persons eagerly

inquire whether it will be fine or rainy. This universal interest in the weather has led the Canadian Government to establish the Meteorological Service, which has its head office in Toronto. This service has observers at hundreds of places in Canada from Dawson City and Fort Churchill on the north to Vancouver and Halifax on the south. Every morning the most of these observers telegraph to the head office their observations of the state of the weather in

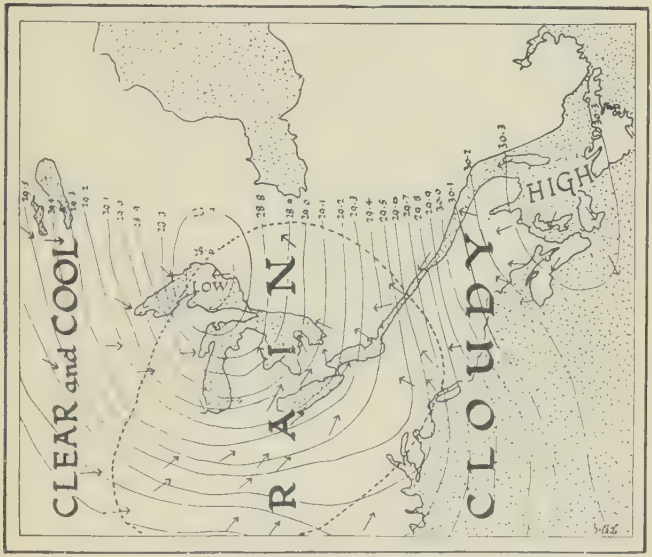


FIG. 29. WEATHER MAP FOR EASTERN CANADA, 14TH DEC. 1920

Space within dotted line is having rain, to the east of this region it is cloudy, to the west clear and cool. Arrows indicate the directions of wind. The isobars are marked.

their localities. From these and other data the forecasts for all parts of the Dominion are prepared.

Sec. 44. How can we forecast the weather?—Suppose we were endowed with eyes with which we could see the air and its motions. Then if we looked down from a station so high that the whole of North America were visible, we should behold a wonderful sight. The air over Canada and the United States would be seen moving in a number of immense vortices or whirlwinds. These vortices would be observed to move forward in a great procession from

west to east. Sometimes they would move forward slowly, sometimes rapidly, and occasionally one would hover over a region for a day or more without making any forward progress. Occasionally the whirling motion in the vortex would become slower and, perhaps, finally cease altogether, when the vortex would disappear. The motions of the air within a vortex are always much the same, and the weather conditions are very similar in corresponding parts of all vortices. Therefore, if the weather conditions in a vortex are known, it is possible to forecast the weather in the various portions of the regions over which it is about to move.

These vortices are called *cyclones*. They are often thousands of miles in diameter. Fig. 29 represents the weather in one of these cyclones, which is just approaching Ontario. It will be seen that in Quebec there will first be south-east winds, increasing in force, followed by cloudy weather and rain. These weather conditions will be followed by north-west winds, which, of course, bring cooler weather. It would usually take several days for such a cyclone to pass. Since cyclones pass one after another in continuous procession, the forecasting of weather becomes possible. Besides these great cyclones small whirls, called *tornadoes* (Fig. 30), less than a mile across sometimes cut a path through a region and leave death and destruction in their wake (Fig. 17).

In tropical regions there is no such changeable weather as in Canada. The trade-winds blow steadily from the same direction, and the weather conditions are the same from day to day.

Climate

Sec. 45. Climate and weather.—*Weather* is the condition of the air from day to day with regard to temperature, rainfall, and cloudiness, while *climate* is the average condition of the air in these respects, calculated from many observations taken over long periods of time and over a more extended area. Since it is not the condition of the air on a single day that affects man's welfare so much as the average condition from year to year, climate is more important than weather from the standpoint of geography.

Sec. 46. The temperature.—The average temperature of a region depends on many factors, the chief of which are latitude, altitude, nearness to large bodies of water, the direction of the prevailing wind, and the relationship to mountains.

Sec. 47. Latitude.—Fig. 31 represents the sun's rays shining on

[Courtesy of United States Weather Bureau.

FIG. 30. A TORNADO PASSING THROUGH A TOWN

the earth. Since the spaces between successive lines are equal in width, they represent equal numbers of the sun's rays. Those between *e* and *f* strike the earth almost vertically, those between *d* and *e* slantingly, those between *c* and *d* more slantingly, and those between *a* and *b* most slantingly of all. The areas of the earth's surface represented by *ef*, *de*, *cd*, *bc*, and *ab* steadily increase from *ef* to *ab*. Therefore, the more slanting the rays the larger the area they have to warm. As the amount of sunlight is the same in every space, since they are of equal width, the rays will not be able to warm a large area like *ab* so intensely as a small area like *ef*. Accordingly, the more nearly vertical the rays, the higher will be the temperature in the region upon which they shine.

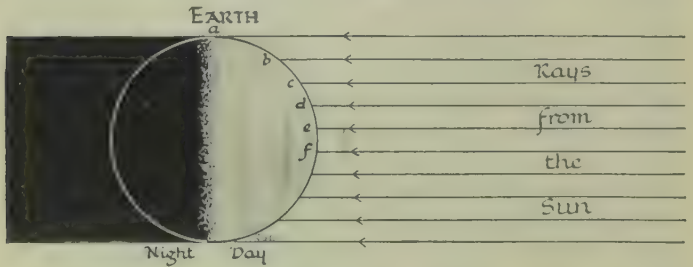


FIG. 31. OBLIQUE RAYS HAVE LESS WARMING POWER THAN THOSE MORE NEARLY VERTICAL

Therefore, the temperature steadily decreases from the Equator to the poles.

Sec. 48. Altitude.—It was explained in Sec. 29 that as air rises it expands and becomes cooler. Hence the higher one ascends in the air, the lower the temperature becomes. Accordingly, as one ascends a mountain, the temperature steadily decreases, just as it would if one went up in a balloon.

Sec. 49. Other factors affecting climate.—As was explained in Sec. 26, a body of water is cooler in summer and warmer in winter than the adjoining land. If the prevailing winds are from the water to the land, the latter will be cooler in summer and warmer in winter than it would otherwise be. There will thus be mild winters and cool summers in such a region. A region with temperatures of this character is said to have an *oceanic climate*. The western coasts of all the continents lying in the regions of the westerlies have oceanic climates. In the interior of a continent, the modifying effect of the ocean is lost, and here there are very cold winters and warm summers. Such climates are said to be *continental*. The extreme continental conditions of both summer

and winter are especially well marked where mountains cut off the moderating winds which blow from the ocean, as in the Prairie Provinces.

Sec. 50. East coasts.—In the region of the westerlies the east coasts receive their prevailing winds from the interior, and they consequently have a climate resembling that of the interior rather than that of the adjoining ocean. In other words, their climate is more nearly continental than oceanic. It is for this reason that the east coast of Canada has such a cold climate.

FIG. 32. MAP OF CANADA SHOWING THE AVERAGE ANNUAL ISOTHERM OF 35° F.

The figures represent average annual temperatures. Draw the isotherms for 30° F. and 20° F.

Sec. 51. Isotherms.—If the average temperatures of places are marked on a map, lines can be drawn through places of equal temperature. Fig. 32 is a map of Canada with a line drawn through all places having an average annual temperature of thirty five degrees. Such a line is called an *isotherm*, and a map with the isotherms marked on it is called an *isothermal map*. Maps 5 and 6 in the Atlas are isothermal maps of the world for January and July.

Questions

1. Of what is the cloud above the spout of a boiling kettle composed? What becomes of the water particles when the cloud disappears?

2. Explain the reason why our breath is visible on a cold winter's day. Are the particles composing this cloud water or ice? Give a reason for your answer.

3. What effect have the Great Lakes on the temperature of Southern Ontario in summer and in winter?

4. Why does the snow melt more rapidly on the south side than on the north side of a mountain?

5. What is the direction of the slopes on which the earliest spring flowers are found? Why are these flowers found here?

6. Examine Maps 3 and 4 in the Atlas, and after studying the winds marked on them, write down a list of the countries or parts of countries that have oceanic climates. Make a list of those that have continental climates.

CHAPTER III

THE OCEANS

Projects

Sec. 52. To study a graphical record of the tides.—Fig. 33 represents the falling and rising of the tides at Father Point for the month of November, 1918. The horizontal lines represent heights above the base line. The vertical lines separate the tides of the different days of the month. What is the height of the first high tide of the month? What is the height of the first low tide of the month? What is the range between the first high and the first low tide? How many low tides and how many high tides are there during the first day of the month? What difference is there between the heights of the two high tides on the first day of the month? Is there an equal difference in height between the two high tides of the day throughout the month? Which are higher, the high tides of the first or of the second day of the month? Which are higher, the high tides of the second or of the third day of the month? Are the low tides of the first day of the month or of the second day of the month the lower? How does the range of the tides change during the first few days of the month? On what day is the least range reached? This is called the *neap tide*. On what day is the greatest range reached? This is called the *spring tide*. When does the second neap tide of the month occur? When does the second spring tide occur? How many days are there between two neap tides? How many days are there between two spring tides? At what phases of the moon do the spring tides occur? At what phases of the moon do the neap tides occur? The first high tide of the month occurred at 12.24 p.m., and the last high tide of the month at 12.04 p.m. Count the total number of high tides of the month and the total time between the first and the last high tides, and then reckon the average time between two successive high tides.

Sec. 53. To study the currents of the North Atlantic Ocean.—Examine Map 7 in the Atlas, and after studying the courses of the currents as indicated in it, answer the following questions: In what direction does the current flow in the Equatorial part of the Atlantic Ocean? What name is given to this current? What happens to this current when it strikes the coast of South America?

Trace the northern branch of it to the Gulf of Mexico. What course does this branch take in the Gulf of Mexico? Where does it leave the Gulf of Mexico? What current flows between Africa and the West Indies? As the current already described leaves the Gulf of Mexico, what other current joins it? What name is given to the current formed by the union? Trace the course of this latter current. What is its rate after it leaves the Strait of Florida? (Read note on the map.) What current flows across the North Atlantic? Name its two divisions. Trace the northern division. What current flows east of Greenland? Where does this current go after reaching the south point of Greenland? What current flows south in Davis Strait? Trace its course as far as you can. Which of the currents of the North Atlantic Ocean are warming currents? Which are cooling currents? What large region of

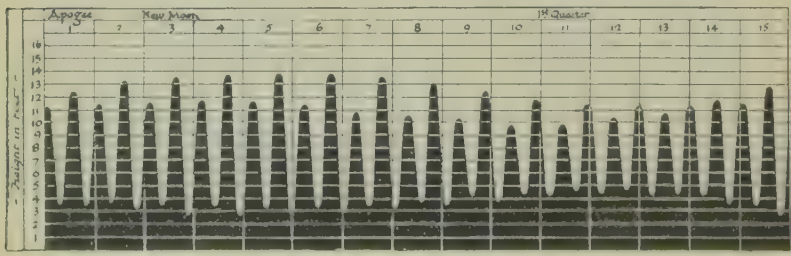


FIG. 33. GRAPH OF THE TIDES AT FATHER POINT

the North Atlantic has no currents? What name is given to this region? Trace the direction of the currents around this region.

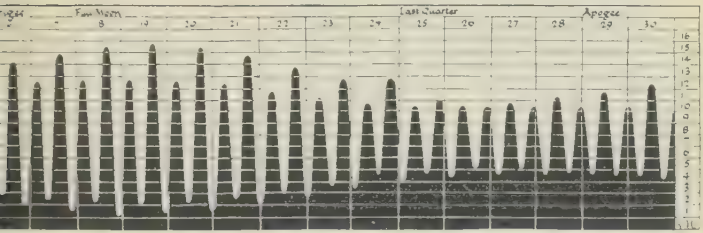
Find similar whirls of water in the South Atlantic Ocean, in the North and South Pacific Ocean, and in the Indian Ocean.

Description of the Oceans

Sec. 54. Boundaries. The earth's crust has three great depressions, which are filled or partly filled with water. The immense bodies of water in these depressions are called the oceans. That which lies between America on the west and Europe and Africa on the east is the *Atlantic Ocean* (Map 2 in Atlas). It extends to the continent of Antarctica in the south. By far the largest ocean is the *Pacific*, which has America on the east and Asia and Australia on the west. It also extends to Antarctica in the south. Both of these oceans extend north almost as far as the Arctic circle and

south to the Antarctic circle and beyond. Extending from Southern Asia to Antarctica is the *Indian Ocean*. It has Africa on the west and Australia on the east. Lying around the North Pole to the north of North America, Europe, and Asia, is a great sea usually called the *Arctic Ocean*. It is so much smaller and more shallow than the other three that it is doubtful whether it should be called an ocean. Around the South Pole there was formerly supposed to be an ocean, but it has recently been found that this region is occupied by a continent called *Antarctica*.

Sec. 55. Depth of the ocean.—The ocean varies greatly in depth in different parts (Map 1 in Atlas). Near the coasts of the continents there is usually a shallow area not more than six hundred feet deep. This shallow part is called the *continental shelf* (Fig. 34). At the outer edge of the continental shelf the water



UEBEC, FOR THE MONTH OF NOVEMBER, 1918

becomes deep very rapidly. The continental shelf is very wide along the east side of North America (Map 25 in Atlas), but is very narrow on the west side. Wide continental shelves are of great importance, for on them are found the greatest fishing grounds of the world. The deepest parts of the ocean are called *deeps*. About fifty of these deeps are known, the greater number of which are in the Pacific Ocean. The lowest deep ever discovered is at a point in the Pacific Ocean, near the Philippine Islands, where soundings revealed a depth of about six miles.

Sec. 56. Temperature of the ocean.—The surface water of the ocean is warmest at the Equator and becomes cooler toward the poles. In frigid regions during the winter it reaches the freezing-point, which for sea water is about 28 degrees. Consequently much ice forms on the ocean in these regions. Everywhere in the ocean the temperature becomes cooler with increase in depth, and at the bottom of the ocean the water is nearly at the freezing-point at all seasons of the year whether in the Arctic Ocean or at the Equator.

Sec. 57. Salinity of the sea.—The water of the ocean is salty. If a hundred pounds of sea-water were evaporated there would remain about three and a half pounds of salt. Scientists are not agreed as to the origin of the salt in the sea.

FIG. 34. SECTION ACROSS THE ATLANTIC OCEAN FROM NOVA SCOTIA TO SOUTHERN ENGLAND

The black represents land, the stippled portion, water. The depths of the water in feet are represented by a number of curved lines.

WAVES

Sec. 58. Nature of waves.—Wherever wind blows on the surface of water, waves are produced. A floating object can be seen to move up and down as the waves pass, but it does not move forward with the waves. If one watches a field of grain when the wind is blowing over it, it will be noticed that waves pass across the surface of the corn and that the heads of grain move up and down while the wave is passing. The same thing happens on the surface of water. The particles of water move up and down while the wave itself moves forward.

FIG. 35. THE BREAKING OF WAVES AS THEY NEAR A SHELVING SHORE

Sec. 59. Velocity and force of waves.—A large wave moves forward faster than a small one, and a wave moves faster in relatively deep water than in shallow water. When a wave approaches the shore, on account of the increasing shallowness its front becomes steeper and steeper, until the water finally topples over, when we say that the wave *breaks* (Fig. 35).

(Courtesy of Canadian National Railways.

FIG. 36. ERODING ACTION OF WAVES

The isolated cliff has been separated from the mainland by action of waves. Lingan Bay, Cape Breton.

Waves on the Atlantic Ocean during great storms have reached a height of more than forty-five feet and a length from crest to crest of more than five hundred feet. Waves on the Great Lakes never reach a height of more than twenty or twenty-five feet.

Waves strike objects with terrific force and are capable of doing great damage. They have been known to move large blocks of stone weighing several tons, and to lift them ten and twenty feet out of the water. They also have great effect in wearing away the shores (Fig. 36). The waves dash the stones against the rocky cliff and gradually undercut it, the fragments being carried away as the waves recede.

Tides

Sec. 60. High and low tides.—If you stand on the shore of one of the bays of the Atlantic or Pacific coasts of Canada, it will be observed that the level of the water changes. For about six hours the water steadily rises. Each wave on the shore advances a little on its predecessor, and the stranded seaweed as well as the stones and boulders become covered by the rising water. Then for half an hour there is no perceptible change of level. After this the water begins to fall and continues to do so for about six hours, when, after a pause, the rise begins again. The rise of the tide is called the *flow*, the fall is called the *ebb*. When the water is at the highest level the tide is *high*, when at the lowest level it is *low*. The period between two highs or two lows is about twelve hours twenty-five minutes.

Sec. 61. Spring and neap tides.—The range of the tides is not the same each day, as can be seen from Fig. 33. For about seven days the high tide of each day is a little higher than that of the preceding day, and the low tide is a little lower. That is to say, the range between high and low tide steadily increases until it reaches a maximum (Fig. 33, 5th November). Then the range steadily decreases for a week, a minimum being reached about 12th November. After that the range increases for another week, again reaching a maximum about 19th November. The tide with the greatest range is called the *spring tide*, the one with the least range the *neap tide*. Spring tide occurs at the time of new and full moon, neap tide at the time of the first and third quarters.

Sec. 62. The tidal wave. The tides are really due to great waves that move across the ocean. These waves out on the ocean are several thousands of miles from crest to crest but are only a foot or two in height. As the crest approaches a place, the tide is rising, as the hollow approaches, the tide is falling. On the open ocean the tide is not much higher than that of the tidal wave just

[*Courtesy of Canadian National Railways.*

FIG. 37. TIDAL BORE AT MONCTON, N.B.

described. This is the condition on oceanic islands and on exposed coasts. Here the tide is only two or three feet high. But when the tide enters a bay or the wide mouth of a river, these act as funnels, and the tidal wave rises higher and higher as it moves farther up the narrowing channel. For example, in the Gulf of St. Lawrence the tide is only about three feet high, at Anticosti it is six feet, at Father Point fifteen feet, at Tadoussac seventeen feet, and at Quebec eighteen feet.

Sec. 63. Estuaries.—The mouth of the St. Lawrence River is an *estuary*, since the tide flows in and out of it. As the tide rises in an estuary, tidal currents flow up the river, and as the tide ebbs, tidal currents flow out. The currents keep the bottom well scoured and prevent sediment from being deposited. Thus estuaries are not liable to have sand-bars, which make navigation difficult. Further, estuaries, even though of small rivers, are navigable for large ships, since at high tide the water is deep. The rivers of Great Britain, though of small size, have the most notable harbours in the world; this is due to the fact that they are estuaries.

Sec. 64. The tides of Nova Scotia.—The highest tides in the world occur in the *Bay of Fundy*. In one of its branches, *Cobequid Bay*, under favourable conditions the tide has been known to rise as high as fifty-seven feet. Another very interesting tidal phenomenon occurs on a small river, the *Petitcodiac*, which flows into the head of the Bay of Fundy. The tide advances as a great wave with an almost vertical front sometimes five feet high, and moves forward with a great roar. This wave is called the *tidal bore* (Fig. 37).

Sec. 65. Cause of the tidal wave. The cause of the tides is much too difficult to explain in such a book as this. All that can be said is that it is due to the fact that the moon exerts a pull on all objects on the earth. The nearer objects are to the moon the greater is this pull. Hence those on the side of the earth nearest the moon are pulled most of all, and those on the opposite side least of all. The effect of this difference of pull is small upon the rigid land, but it causes the water to rise in waves one on each side of the earth (Fig. 38).

Ocean Currents

Sec. 66. The currents of the Atlantic Ocean (Map 7 in Atlas).—In the Equatorial region of the Atlantic Ocean the surface water moves across the ocean from east to west in a slow, broad current called the *South Equatorial Current*. At South America it divides into two, one flowing south, the other north. The northern branch enters the Gulf of Mexico. This current by pouring water into the

Gulf of Mexico causes its level to rise, and a head is formed, which tends to force the water out through any opening available. Accordingly a deep, swift current leaves the Strait of Florida. This current, called the *Gulf Stream*, flows parallel with the eastern coast of the United States, and can be traced as far as the south of Newfoundland. Here for at least a good part of the year it mingles its waters with the cold waters of the *Labrador Current*, which flows south along the coast of Labrador and Eastern Newfoundland.

Across the North Atlantic Ocean a broad, slow current, called the *West Wind Drift*, flows from west to east. It divides into two branches, a southern which flows past the coast of Africa to again join the Equatorial Current, and a northern which flows past Ireland, Scotland, and Norway.

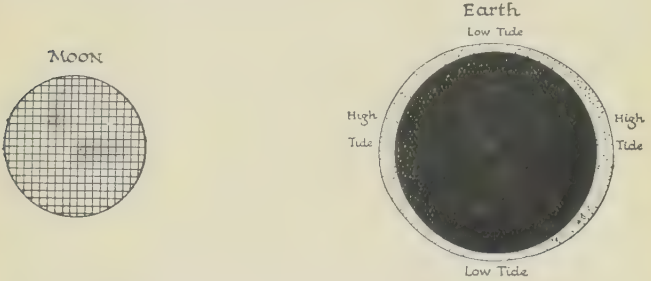


FIG. 38. THE RELATION BETWEEN THE RELATIVE POSITIONS OF THE EARTH TO THE MOON AND THE TIDES

In the North Atlantic Ocean there is thus a great eddy, formed by the North Equatorial Current, the Gulf Stream, the West Wind Drift, and the Canaries Current (Map 7 in the Atlas). At the centre of this whirl is a vast region having no steady currents. In part of this region there is much drifting seaweed. In fact so densely does this weed cover the water in some places that it appears firm enough to walk upon. This region is called the *Sargasso Sea*. The seaweed is brought by the currents from the coast of America and collects at the quiet part of the whirl. Here it grows for a time but finally dies and sinks to the bottom.

Similar whirls are found in the South Atlantic, the North and Southern Pacific, and the South Indian Ocean (Fig. 39).

Sec. 67. Cause of currents.—If a wind blows along the surface of the water there will be a steady drift of the water in the direction of the wind. If the map of the winds of the ocean (Maps 3 and 4 in the Atlas) is compared with that of the currents of the ocean (Map

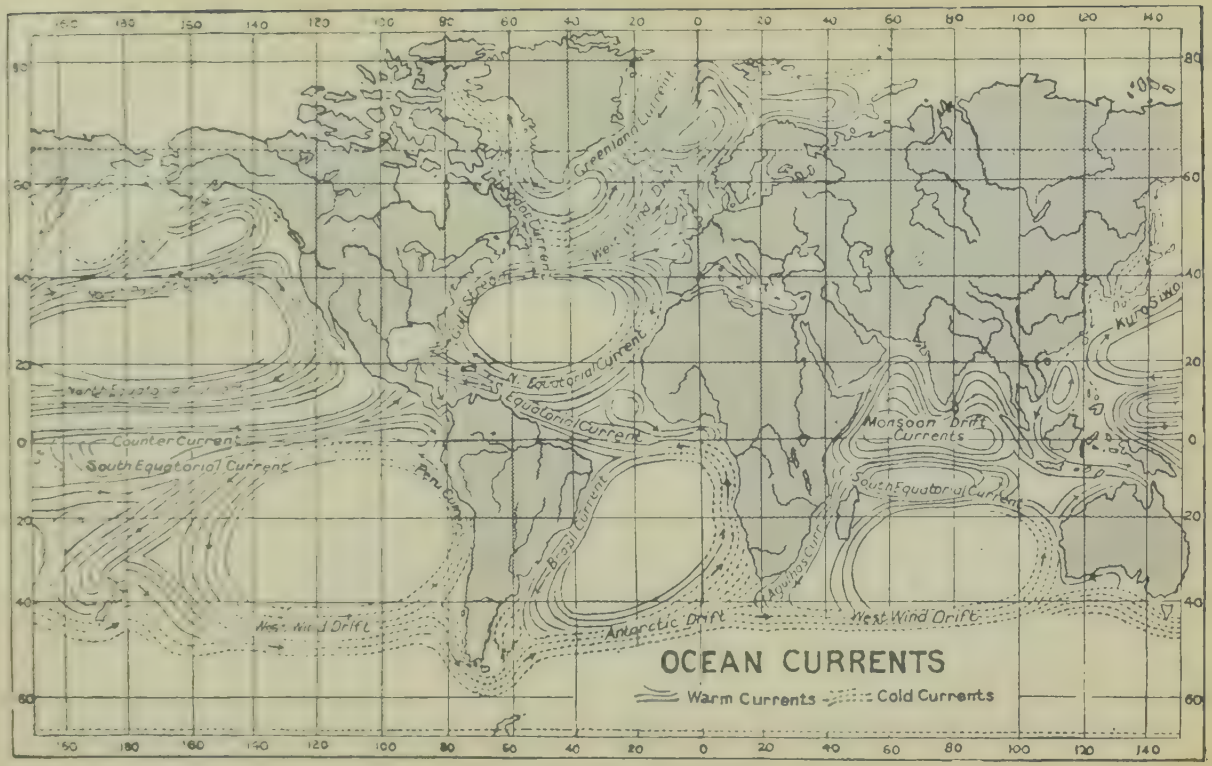


FIG. 39. THE OCEAN CURRENTS

7 in the Atlas) it will be seen that their general directions are the same. In the trade-wind belt the currents flow from east to west, and in the region of the westerlies they flow from west to east, thus following the winds in each case. The close correspondence between the winds and currents was shown by a British geographer. He made a model of the North Atlantic Ocean, put water in it, and allowed air currents to blow over it to represent the trade-winds and the westerlies. At once the water began to move, and the currents of the North Atlantic Ocean were reproduced with great fidelity. The rotation of the earth on its axis causes the same deflection of the currents as of the winds (Sec. 36). They are deflected to the right in the northern hemisphere and to the left in the southern hemisphere.

Sec. 68. Effects of currents on climate.—Currents can only warm or cool the air immediately above them. If this air is blown on to the land it may affect the climate. Usually the wind carrying the air from the water to the land is the great modifying factor, making the land to which it blows warmer in winter and cooler in summer. Ocean currents have little direct effect upon the climate of adjoining lands.

The Uses of the Ocean

Sec. 69.—The oceans have become the highways of commerce. In earlier times, before man had learned to sail skilfully, the oceans were great barriers separating nations, so that for many centuries America and Australia were undiscovered continents. But now the oceans bring all parts of the world closer together. They form the cheapest means of transportation and make it possible for such bulky articles as grain and lumber to be profitably carried from America to Europe. When we think of the great variety of foods, clothing, and other manufactured articles that we all consider necessities, we must never forget that a very large proportion of them would be unavailable if it were not for the fact that man has learned to use the ocean for his commerce.

The oceans have important effects upon the temperature and rainfall of adjoining lands, as has already been pointed out (Sec. 49).

Sec. 70.—The oceans swarm with plants and animals in great variety and abundance. Many of these animals are useful to man. The various fishes are used as food; the skin of seals makes valuable fur, the hide of the porpoise and of other sea animals is used for leather; the oil of seals, whales, walrus, and fishes is used for a variety of purposes. It is only necessary to mention sponges, coral, pearls, sepia, and salt as additional products obtained from the sea.

CHAPTER IV

THE CHANGING OF ROCK INTO SOIL

Projects

Sec. 71. To study the structure of a piece of granite.—Examine a piece of granite. (The pink or gray mottled monuments in a cemetery will do.) How many differently coloured substances are there in granite? Examine the black grains to see if they are in flakes. What is the black component of granite? Which component shows a smooth face on the broken surface of the granite? Which shows a rough face? Find which substances in the granite can be cut with a knife. Test if any component scratches glass.

Sec. 72. To study the structure of pieces of shale, sandstone, and limestone.—Which of these rocks splits in layers? Find which smells of clay when it is breathed upon. Which bubbles when a drop of acid is put on it? Which scratches glass? Examine each with a lens. Which is coarsest grained? Which is finest grained?

Sec. 73. To study the weathering process.—Examine a clod in a ploughed field during the spring of the year. What changes in texture take place in it? Does it break up as spring advances? Break one clod open to find if it has frost in it. How does the alternate freezing and thawing affect the texture of the lump? Why do farmers plough tough clay fields in the autumn?

Examine exposed stones in the spring of the year. Do any show signs of breaking up? How does the surface of an old tombstone in a cemetery differ from that of the newer ones? Which retain their polish longer, the white tombstones, which are made of marble, or the gray and pink mottled ones, which are made of granite? What evidence is there of the cause of the dulling of the surface of tombstones with age?

Examine a nail drawn from an old board that has been exposed to the weather. Has the nail become roughened like the tombstone? If it were left, what would finally become of the nail? Examine rocks in your neighbourhood for rust stains. What is the explanation of the rust stains on them?

Sec. 74. To examine a talus. If there is in your neighbourhood a steep cliff, a sand bank, a high river bank, or a lake bluff, examine the foot of it in the spring while the frost is still in the ground. What has collected there? Whence has the material come? Why

does such a mass, called a *talus*, collect especially in the spring? Examine the cliff above to find evidence that the mass below came from the cliff. Are there cracks in the cliff? Are there any masses part of the way down the cliff which have evidently fallen from above? How does frost cause the fissures to form in the cliff? What effect has frost on the steepness of a slope?

Soil

Sec. 75. Position of soil.—The outer layer of the earth's crust is composed of a number of substances. At the surface there is usually soil, but everywhere beneath the soil there is solid rock. In some regions the soil is fifty or even one hundred feet thick, in others it is very thin, while in places the rock projects through it. Over large areas of Northern Ontario and Quebec the bare rock is exposed.

Sec. 76. Composition of soil.—Soils differ a good deal in composition. Usually, however, they consist of three components: *sand*, *clay*, and *humus*. The coarser part is sand, the finer is clay, and the humus, which is formed by the decay of plant and animal remains, gives the soil its blackish colour. When soils have no black colour they have little or no humus. Occasionally the soil is composed almost of pure clay, and it is then very light in colour; or of pure sand, in which case it is gray, yellow, brown, or even red. Occasionally, as in marshes, it may be largely humus, when it is called a *muck soil*.

Weathering

Sec. 77.—We have reason to believe that the sand and the clay, of which soil is composed, are made by the crumbling of rocks. One of the chief causes of this crumbling is the process called *weathering*.

Sec. 78. Weathering action of the air.—We often think of rocks as the most enduring objects in the world and speak of an object as being "firm as a rock." Yet we have evidence that even rocks cannot withstand the tooth of time. If an old tombstone be examined, the surface will be found to be dull and uneven, though when first erected it was smooth and polished. Many old stone buildings are observed to be crumbling. What is the cause of this change? If a piece of iron is exposed to the air and rain, it soon becomes rusty, and in the course of a few years entirely crumbles

to pieces. The oxygen and moisture of the air unite with the iron of the nail to make the soft rust. In the same way the gases of the air act slowly on substances in the rock and convert them into softer substances, which crumble to pieces. The oxygen, carbon-dioxide, and moisture of the air are most active in this decay. This action takes place only on the very surface of rocks. It is most active in humid climates, for there the abundant moisture hastens the process.

Sec. 79. Weathering action of water.—The rain in falling dissolves oxygen and carbon-dioxide from the air, and as it passes through the soil and rocks, dissolves other substances from them. All these dissolved substances, as well as the water itself, act on the rocks and cause their decay. As this ground-water may penetrate deeply into the rocks, this weathering agent may cause the decay of rocks far beneath the surface.

Sec. 80. Weathering due to change of temperature.—When water turns into ice it expands. An iron pipe, which is filled with water and sealed, breaks when the water freezes. This shows the great force of freezing water. Similarly, when the water freezes in the pores of a piece of rock, the expansion of the ice tends to produce cracks in the walls of the pores. This process, often repeated, will in time cause the rock to crumble. Again, when water freezes in a crack in a rock, the ice acts as a wedge and widens the crack. In the spring of the year, when there is much freezing and thawing, this process often causes pieces of rock to split off from the sides of steep precipices and rocky mountain slopes. Usually at the base of such slopes in cold humid climates there is a pile of debris that has fallen from above. Such a pile is called *talus* (Fig. 40). Finally, the surface of a bare rock that is alternately heated and cooled tends to expand and then to contract, but as there is no change in temperature in the internal parts of the rock, a strain is set up at every expansion and contraction. These successive strains in time cause cracks to appear. This is one cause of the cracking of cement pavements and buildings.

Sec. 81. Weathering by plants and animals. Roots of trees, as they grow down into fissures and enlarge through growth, act as wedges, causing the fissures to widen and deepen. Mosses and lichens that grow on bare stones excrete substances that corrode the stones, so that in time their surfaces crumble. Such burrowing animals as the gopher and ground hog assist the weathering process, since they bring small stones to the surface, where they are more readily acted on by the other weathering agents. The burrows also allow the water to penetrate more readily into the ground and thus accelerate its weathering action.

[*Courtesy of New York Central Railway Co.*

FIG. 40. A TALUS AT THE PALISADES OF THE HUDSON RIVER

The sloping mass of stones and earth partly covered by small trees has been broken from the vertical cliff above.

Action of the Wind

Sec. 82. Sand and dust.—When the sun shines through a slit into a darkened room, millions of little particles are seen dancing in the sunlight. These are particles of smoke, spores of plants, and very fine grains of rock, all kept suspended by air currents. They are called *dust*. When stronger winds blow, larger grains are lifted from the ground, but they are carried only a short distance before they fall to the earth again. These heavier grains are called *sand*.

Sec. 83. Sand dunes.—Where there are large areas of dry sand it drifts rather like snow, and forms hills, called *dunes*, often twenty or thirty feet high. They are usually formed where the

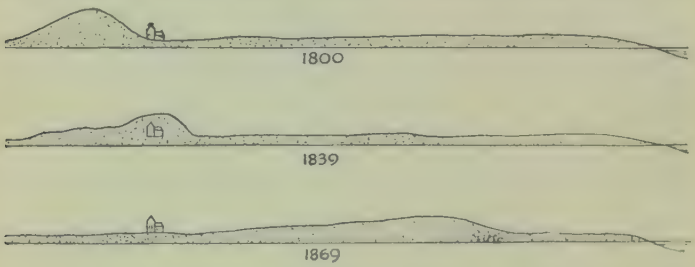


FIG. 41. BURIAL OF A CHURCH BY A SAND DUNE AND ITS LATER UNCOVERING

The date is under each section. What is the direction of the prevailing wind?

prevailing wind is from one direction. They are not stationary, but advance over a district, burying trees and houses; in time as they advance farther, the trees or houses may be again uncovered (Fig. 41).

Dunes do so much damage that in many parts of the world people plant grasses or shrubs in the sand in order that their roots, by binding it down, may prevent it from further drifting. This plan is being adopted over sandy stretches along the coasts of Lakes Erie and Ontario.

Sec. 84. Buried cities.—Where the prevailing winds are from the desert, small quantities of sand are being continually drifted by the wind, and inch by inch raise the level of the region. The buildings are gradually submerged, and in time a whole city may be buried. In fact, numerous cities scattered over extensive regions of Asia and Africa have been buried in this way. Thick deposits of sand laid down by the agency of the winds are found in several parts of the world. Such deposits are called *loess*.

Sec. 85. Erosion by sand.—When sand is driven by wind against rocks, it gradually wears them away. Rocks cut by sand in this way often assume fantastic shapes (Fig. 42). Such wind erosion as we have just described takes place only in rainless regions and is most pronounced on the windward side of the rocks.

[*Courtesy of Union Pacific Railway.*

FIG. 42. THE "RED BUTTES OF WYOMING," PARTLY ERODED BY WIND

Questions

1. Why have no buried cities been found in Europe?
2. Along the base of the precipice bounding the eastern side of the Niagara Gorge is a trolley line. Each spring before the line is opened for traffic it is necessary to clear away masses of rock that have collected on it. Explain why this material collects.
3. A large stone monument was taken from Egypt, where it had stood for centuries, and erected in New York City. In a few years the surface began to chip off. Why should this change take place in New York and not in Egypt?
4. Large sand dunes are found along one side of Lake Michigan. Are they on the east or the west side? Give a reason.

CHAPTER V

UNDERGROUND WATER

Projects

Sec. 86. To study the porosity of rocks.—Weigh pieces of several kinds of rock, such as granite, sandstone, limestone, and shale. Put them in a vessel of water and heat the water strongly for thirty minutes. As the water is being heated, notice from which pieces bubbles rise most freely. Of what gas are these bubbles composed? What replaces this gas in the rocks? After the water cools, wipe the surplus water off each piece and weigh again. Which has increased most in weight? Why? Which are the most porous? Through which rocks would water soak most readily?

Sec. 87. To make an artificial spring.—Place a layer of clay about one inch deep in the bottom of a chalk-box. Make the surface of the clay slope from the ends toward the middle so as to form a shallow trough. Also have a slight slope from the back to the front of the box. Bore several gimlet holes through the front of the box on a level with the surface of the clay, being sure to make one hole opposite the lowest part. Also bore holes through the front at higher and lower levels. Now pack moist sand into the box until it is full and gradually pour water on the moist sand. Find through which holes the water escapes most freely.

Sec. 88. To study the wells of the school section. Find the following data about the wells at your home: The total depth; the distance from the surface of the water to the top of the well; the kind of soil in which the well is dug; whether the surface of the water rises and falls with the season; at what season it is lowest; at what season it is highest; whether a heavy rain affects its height. From the data obtained about several wells, draw conclusions as to the sources of the water in the wells.

The Absorption of Water

Sec. 89. The ground water. The rain and snow that fall to the ground are disposed of in three ways. Some runs off as streams, some evaporates, and some sinks into the ground. This latter is called the *ground water*. Where the surface is level, the soil or

rock porous, and the rainfall steady, a very large proportion sinks into the soil or rock.

Sec. 90. The porosity of rocks. –Some rocks and soils are much more porous than others. Sandy soils absorb water readily, but clays are not very permeable to water. Granite, shale, and slate are almost impermeable; on the other hand, many sandstones and limestones are quite porous. Water not only enters through pores, but also through cracks and between layers. At great depths in the earth the pressure is so great that all pores and cracks disappear. Accordingly the water that sinks into the ground never penetrates to great depths; most of it does not penetrate a mile, and none of it ever penetrates more than five or six miles.

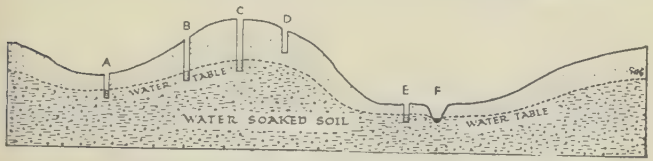


FIG. 43. SECTION THROUGH EARTH SHOWING THE RELATION OF WELLS TO THE WATER TABLE

The dotted line is the water table. A, B, C, D, and E are wells. Which is dry? F is a stream.

Sec. 91. The water table.—The soil or rock up to within a certain distance of the surface is water-soaked. The surface below which the soil or rock is water-soaked is called the *water table* or *ground-water level* (Fig. 43). It rises after a shower of rain and sinks during a period of dry weather. Sometimes during heavy rains it rises to the surface, and then pools of water collect on the ground.

Wells and Springs

Sec. 92. Surface wells.—When a hole dug in the ground extends below the water table, water will ooze out of the side and bottom of the hole until it is filled with water about to the level of the water table. Such a hole when bricked in is called a *surface well* or *dug well* (Fig. 43, A, B, C, E). The water supply for many of the rural parts of Canada is obtained from such wells.

As the water table rises and falls the water rises and falls in the well. If the water table sinks below the level of the bottom of the well, as it is likely to do during prolonged dry weather, the well goes dry (Fig. 43, D). In the Prairie Provinces, where the water table is very low during the dry weather of late summer, it is very difficult to obtain a sufficient supply of water.

Sec. 93. Artesian wells and springs.—If a layer of porous rock is exposed to rain as at C in Fig. 44 and is overlaid by an impervious layer B, then the water that soaks in at C is prevented from escaping at a lower level by the overlying impervious layer. If a hole is drilled through the impervious layer, as at K, the water from the porous layer will rise through the opening up to nearly the level of the water-table. Since in the case illustrated this is higher than the surface of the ground where the hole is drilled, the water rises in a fountain from the boring (Fig. 45). Such a boring is called an *artesian well*, whether the water flows out or has to be pumped. The region C where the water enters may be many miles away from where the boring is made. If a crack occurs in the impervious layer as at N, the water will flow out in a spring. The only difference between the well and the spring is, that in one case the

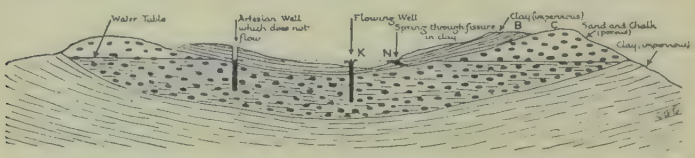


FIG. 44. SECTION OF STRATA UNDER LONDON, ENGLAND, SHOWING ARTESIAN WELLS AND SPRINGS

opening occurs naturally and in the other it is artificial or made by man.

Artesian wells are not likely to go dry, as their supply of water comes from a distant source, which has usually a large area, over all of which there is not likely to be a drought at one time. Moreover, the source of supply may be so much higher than the point where the well is located that the water table is very unlikely to sink so much as to fall below the bottom of the well.

Solution in Ground Water

Sec. 94. Mineral waters.—All water that passes through the soil or rocks dissolves substances from them. Water that penetrates deeply into the rocks is under great pressure and may become heated. In these circumstances it dissolves many substances that would not be dissolved under ordinary conditions. Such water appearing in springs and in artesian wells has frequently a peculiar odour and taste. Springs of this character are called *mineral springs*, and such water is called *mineral water*. Mineral water is

[*Courtesy of Queensland Government.*

FIG. 45. A FLOWING WELL IN AUSTRALIA

It was dug almost one mile in depth, and 750 gallons flowed from it each second. The water was quite hot.

frequently used by invalids for bathing and for drinking, since it is supposed to have curative value.

Sec. 95. Veins.—As heated water rises from great depths it becomes cooler, and the pressure upon it is diminished. Consequently, it cannot always retain all the substances dissolved at greater depths, and it deposits them along its path. Hence the cracks along which it flows become more or less filled with these deposits. Such deposits are called *veins*. Much gold, silver, lead, zinc, etc., are found in such veins, and these minerals are considered to have been deposited by water in the manner just described.

Questions

1. Which would be more likely to go dry, a well dug in a hollow or a well dug on a hill?
2. Why is the water in wells and from springs usually cool in the summer?
3. If two wells are dug close together is the level of the water in one likely to affect the level in the other?
4. Why does a sandy road dry up more quickly than a clayey road?

CHAPTER VI

RUNNING WATER

Projects

Sec. 96. To study the process of erosion.—Break a piece of sandstone or limestone into pieces small enough to go into a medicine bottle. Wash the bottle, drop twenty or thirty of the pieces into it and keep several out for comparison. Half fill the bottle with clear water and shake it for at least half an hour. Now examine the water. Is there any sediment in it? Compare the pieces of stone that were in the bottle with the others. Which are more jagged at the edges? Which are the more rounded? Where did the sediment in the bottle come from? Why are pebbles in the bed of a brook and on the lake shore rounded?

Sec. 97. To study the action of running water in a small stream.—A rivulet on the roadside will serve for this exercise. Collect a bottle of water from the stream and let it stand for a day. What is at the bottom of the bottle? Note whether there is a delta formed where the stream widens out or empties into a pool. Explain the cause of each turn in the stream. Where a curve occurs, note the nature of the bank on the outside and on the inside of the curve. Which bank is steep? Which is formed of sediment deposited by the stream? Explain the cause of swift currents, rapids, and waterfalls in the stream. Why are projecting pebbles left in the bed?

Work of Running Water

Sec. 98. The run off.—During a heavy shower the rain can be seen to run off the smooth pavement in a sheet. But on the uneven surface of the ground it seeks the lower parts and runs in streams. During the spring, when the melting snows are disappearing, many little streams may be seen on the roadside. They have worn channels for themselves and the muddy condition of the water moving in the channels is evidence that particles of soil are being carried along to be deposited farther down.

Sec. 99. Gullies.—After a heavy rain the water running over the edge of a bank frequently washes out a furrow-like trough, the material washed out being deposited as a fan-shaped mass at the

[*Courtesy of Chicago, Milwaukee, and St. Paul Railway.*

FIG. 46. WISCONSIN RIVER, SHOWING THE ROCKY BANKS WHICH HAVE BEEN ERODED BY RUNNING WATER

bottom of the bank. Each succeeding rain-storm wears the trough, or *gully*, as it is called, deeper and wider. It will also be worn back farther from the bank. Later, tributary gullies will be formed emptying into the older gully. This is the way in which a river begins.

Sec. 100. Erosion of a river.—The swiftly-moving water of a stream is able to wear away soft soil from its bank and bottom though it has practically no effect on hard rock. But the water running from the land into a stream is turbid, which means that it has little grains of sand and clay in it. These substances, striking the rocky banks and bottom of a stream, are very effective in wearing away even hard rocks (Fig. 46). When the current is very swift, as during high water, not only sand but small pebbles are carried along in the stream. As these rub against the bottom, they wear it gradually away, no matter how hard it is, and are themselves worn during the process. The eroding effect of pebbles striking together can be shown by putting some small lumps of broken limestone into a bottle of clear water and shaking the bottle for half an hour. A certain amount of sediment will settle to the bottom of the bottle, and it will be found that the jagged edges of the stones have become considerably rounded.

Running water also wears away its bed by dissolving the soluble parts of the rocks and soil with which it comes in contact as it moves along.

Sec. 101. Transportation and deposition.—The size of the pieces of sand or pebbles that running water is capable of moving down stream is determined by the current. The swifter the current the larger the pieces that it can carry. Accordingly, wherever the current slackens on account of the widening of its channel, sediment is deposited, and the bed becomes more shallow. This explains the difficulty of keeping a deep channel in the St. Lawrence River at places like the heads of Lakes St. Louis and St. Peter. When a river pours its water into a lake or sea, the current rapidly lessens, and very much sediment is deposited. Usually a fan-shaped deposit, called a *delta*, is formed at the mouth of the river (Fig. 47). The water flowing through the delta is so clogged with mud that the river usually breaks up into a number of streams.

Sec. 102. The layers of sediment.—In a delta the coarser sand is deposited first, and farther out the finer clay. As the rate of the current varies from time to time, the coarseness of the material laid down at any one place varies also. When the current runs swiftly over the region of deposition, coarse materials only are dropped; as the current slackens after a freshet, finer and finer materials are dropped on top of the coarser, and with every freshet a new layer will be superimposed. If the river flows for a long

period, sediments thousands of feet in thickness and covering many thousands of square miles may be deposited. Such beds of

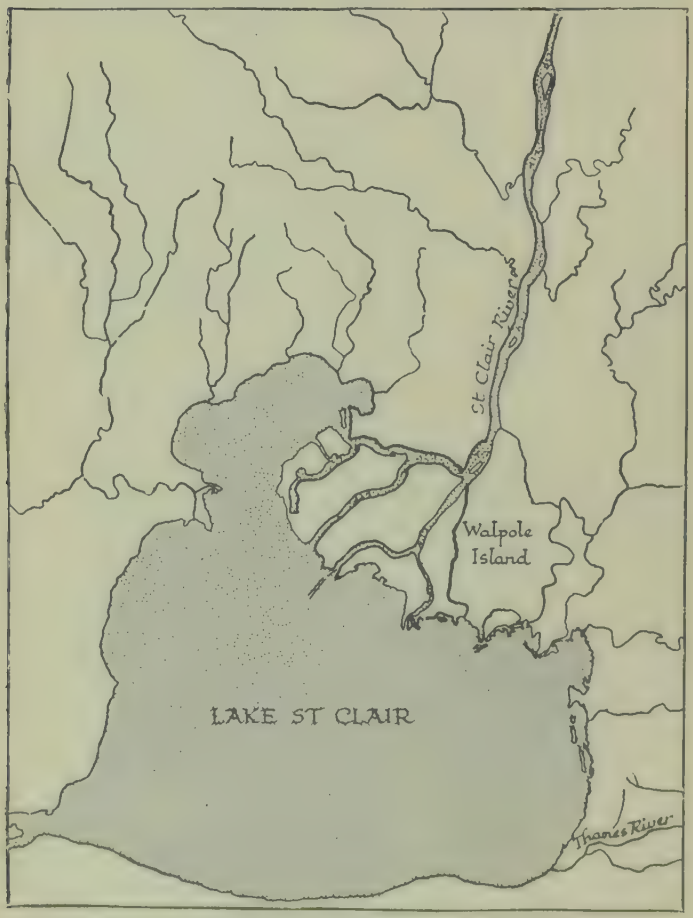


FIG. 47. DELTA AT THE MOUTH OF ST. CLAIR RIVER

sediment, when raised above the surface of the water, make exceedingly fertile soils. Since the surface of such a deposit is flat, it is easily cultivated, and the construction of roads and railways offers no difficulties. So we find that some of the most civilized nations of the past occupied deltas, and on similar regions are

found to-day some of the densest populations of the world. The ancient Egyptians dwelt on the delta of the *Nile*, the Assyrians and Babylonians on the deltas of the *Euphrates* and *Tigris*. The deltas of the *Rhine* and *Po* in Europe, of the Nile in Egypt, and of the rivers of India and China in Asia are some of the most densely populated parts of the world.

Sec. 103. Sedimentary rocks.—When the sediments become very thick, the lower layers, which support the upper ones, are subjected to very great pressure. Moreover, water with substances dissolved in it is continually sinking through these sediments and often deposits some of the dissolved materials between the grains.

[*Photograph from Geological Survey, Canada.*

FIG. 48. STRATIFIED LIMESTONE, HASTINGS COUNTY, ONTARIO

Notice the plants growing in chinks and causing weathering.

thus cementing them together. By means of this pressure, as well as the cementing process, and in some cases heat, these sediments are converted into hard rocks. The sand becomes *sandstone*, the clay becomes *shale*, and if the sand grains are made of particles of coral or of broken shells of animals, as they frequently are, the consolidated particles become *limestone*. Such rocks, being made, as stated above, of layers of different coarseness, show the layering in cross section (Fig. 48). For this reason they are called *stratified rocks*. They are also called aqueous rocks because they are laid down in water, and *sedimentary* because they are made from sediments.

Sec. 104. Waterfalls and rapids.—Where the channel of a river drops suddenly from a greater to a lesser height, a waterfall occurs. The *Montmorency Falls* below Quebec and *Niagara Falls* are good examples in Canada. As a result of erosion, waterfalls in time become rapids, and rapids become swift currents.

History of a River

Sec. 105. The life of a river.—Suppose some new land were for the first time elevated above the sea or laid bare by the melting of an ice-cap (Sec. 201). The rain that fell would collect in the

FIG. 49. A MEANDERING STREAM ON THE PLAIN OF HUNGARY

hollows. As a hollow filled, the water would overflow at the lowest part of its rim, and a stream would run along to a lower hollow, which would also fill and overflow. This process would continue until finally the water reached the sea. The hollows filled with water are *lakes*. The connecting streams flow in most irregular channels, determined by the depressions of the land. At some places they will be wide and shallow, at others narrow and swift, and waterfalls are likely to occur. Such is the character of a newly-formed river, of which the St. Lawrence is a typical example.

As time passes the rims of the lakes at the points where they are drained become worn lower, the lakes shrink more and more and finally disappear, and only the river is left flowing through the middle of their old beds. The waterfalls in the streams gradually

become less steep, and are then converted into rapids, and finally into swift currents. At first the channel of the river becomes deeper and deeper as it erodes its bed. Consequently its banks become higher and higher. Then by means of weathering the banks become less steep, and the weathered material falls into the stream and is carried away by its swiftly flowing waters. The valley worn by the river is now a *gorge* or a steep *ravine*.

In time the bed of the river near the mouth is worn as low as the sea or lake into which it empties and can be eroded no lower. The

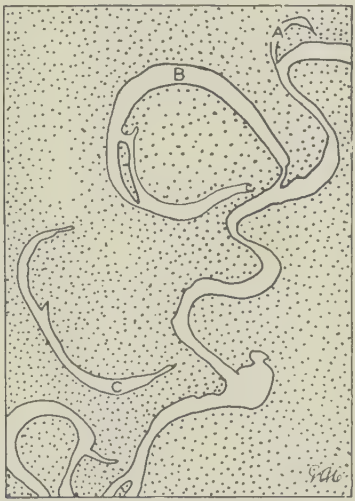


FIG. 50. A PART OF THE MISSISSIPPI RIVER SHOWING SEVERAL MEANDERS A, B, AND C, CUT OFF TO FORM OX-BOW LAKES

running water, however, can still erode the sides of the bed, and undercut the steep sides of its valley (Fig. 46). This undercutting is especially marked at every curve. The current on the outside of the curve is swift, and there is an undercurrent across the river from the outside to the inside. Consequently the bank bordering the outside of the curve is cut away, and the sediment is carried over and deposited on the inside. The course of a stream will thus become more and more curved. These curves are called *meanders*, after a river in Asia Minor, well known in ancient times, and the stream containing them is said to *meander* (Fig. 49). Many streams in Canada have such curves in their lower courses. In time two of

[*Photo, of Geological Survey, Canada.*

FIG. 51. FLOOD-PLAIN OF BRIDGE RIVER, BRITISH COLUMBIA

It shows meanders and ox-bow lakes.

the curves will meet and the meander will be cut off (Fig. 50). As the meanders swing right and left, the steep sides of the valley will be cut farther back, and a low flat plain, called the *flood-plain*, will be formed, bounded with ravine-like sides (Fig. 51). During a rainy season the river is likely to overflow its banks, flood its valley, and deposit much sediment. Consequently, these flood-plains form very fertile lands, and like deltas, usually support thriving populations.

Sec. 106. Old age of a river.—As time passes the valley of a stream widens and its sides become worn down. Its basin becomes lower and lower even up toward its source, and its current becomes more sluggish. The final stage is reached when its whole basin becomes a flat plain, little above the level of the sea into which it empties. It is then called a *peneplain* (from Latin *paene*, "almost," *i.e.* almost a plain). The whole northern region of Ontario and of Quebec has been worn down to a peneplain and is still comparatively flat, though it has again been somewhat elevated, and the rivers have thus received a fresh start.

CHAPTER VII

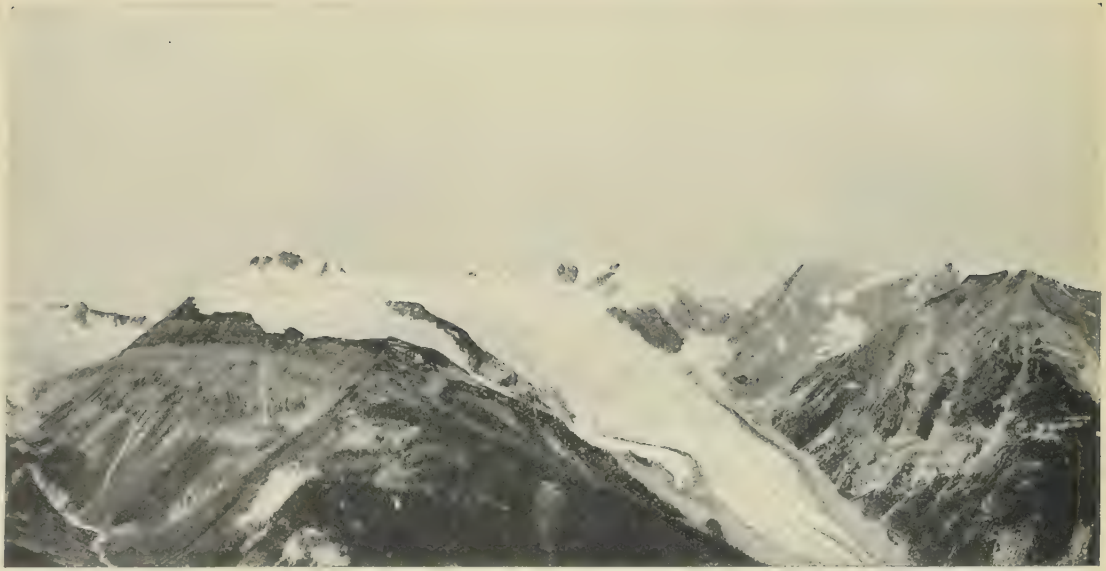
WORK OF ICE

Sec. 107. Lake ice.—Not only do running and underground water affect the shape of the land, but frozen water, or ice, is also an important factor in regions such as Canada, where many of the smaller lakes and most of the rivers freeze during the winter. On a very cold day the icy covering of a lake or river, like most other solids, contracts. As a result of this contraction the ice cracks with loud reports. The cold water then wells up through the cracks and freezes. When the weather becomes warmer, and the ice expands, its edges are pushed up on the shore. These successive processes of contracting, freezing, and thawing continue through the winter. As the edge of the ice forces its way up on the shore, it pushes stones and logs before it. Consequently, on the borders of many rivers and lakes in Quebec and Ontario a line of debris is deposited.

Sec. 108. Glaciers. On many high mountains the summer temperatures are so low that there is not enough heat to melt the snow that has fallen during the winter. As a result the snow accumulates year after year until it may become hundreds of feet in thickness. The great weight of the snow presses the bottom layers into ice and forces the margin of the snow-cap out on all sides. Tongues of ice and snow are thus pressed slowly down into the valleys. Such tongues are called *glaciers* (Fig. 52).

Sec. 109. Description of a glacier. Glaciers have their origin in the snow field covering the upper parts of a mountain and force their way down to the valleys below. They are composed of ice usually covered with snow. The glacier moves very slowly down the valley, bending round the curves, and becoming narrower toward the lower end. Its rate is usually not more than a few feet per day, and it moves faster at the centre than toward the margins. Frequently the surface is very rough and has many transverse cracks, caused by the uneven ground. Much soil, stones, and other debris are on the margins, and often in lines running along the surface near the middle. These lines of deposit are called *moraines*, those near the margin being called *lateral moraines*, and those away from the margin *median moraines*.

As a glacier moves down the valley into the warmer regions, it



[*From photo. of Geological Survey, Canada.*

FIG. 52. SNOW-FIELD AND GLACIER IN KOOTENAY DISTRICT, BRITISH COLUMBIA

Notice the median moraines, also the crevasses where the glacier flows over a slope.

forms a great contrast to the bordering land covered with trees, grass, and flowers. In this part of its course it melts very rapidly, so that from the lower end of it a turbid, raging stream flows down the valley. As it melts, all the soil, boulders, etc., that it has gathered above are deposited in a great mass at the lower end. This deposit, which is called a *terminal moraine*, is a mixture of clay, sand, pebbles, and stones of all sizes. Such unstratified masses of unsorted materials, in contrast to the well-sorted, stratified sediments deposited by running water, are called *boulder clay* or *till*. The work of glaciers is further considered in Sec. 201.

CHAPTER VIII

EARTHQUAKES AND VOLCANOES

Earthquakes

Sec. 110. Movement of the earth's crust.—We must not think of the crust of the earth as fixed and unbending, for we have good evidence that it has in many places moved slowly up and down a great number of times. There have been found on Mount Royal in Montreal, over five hundred feet above the level of the sea, the remains of sea animals. This fact with other evidence indicates that when these remains were deposited the region of Montreal was over five hundred feet lower than it is at present. It was in fact so low that a great arm of the Atlantic Ocean filled a good part of

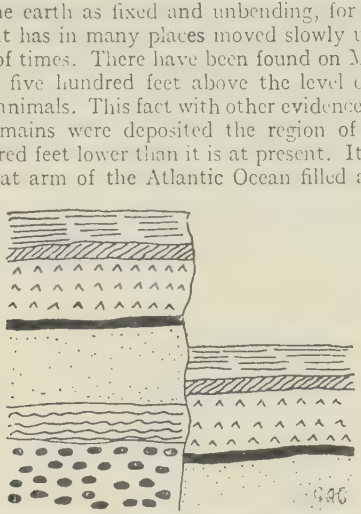


FIG. 53. A FAULT. THE LEFT SIDE HAS BEEN RAISED ABOVE THE LEVEL OF THE RIGHT SIDE

what is now the St. Lawrence Valley. Moreover, the bones of a whale have been found in Eastern Ontario, indicating that this region, too, was once much lower than at present. Other evidence points the same way. Paved streets of a Swedish coast city are now actually six feet under the sea, and on parts of the Alaska coast the trunks of trees have been observed standing erect, partly immersed in the sea. In both cases the land has evidently sunk.

Sec. 111. Faults.—In many places there are vertical cracks, some of them of great length, in the crust of the earth. Owing to rock

movements from below, the rock on one side of this crack may be forced up or sink down. In either case the two surfaces of the crack reveal a series of corresponding layers of rock, though these corresponding layers are now at different levels. Such a crack is called a *fault* (Fig. 53).

Sec. 112. Cause of earthquakes.—When a heavy truck or a street-car passes over a pavement it often makes the windows in adjoining houses rattle. A tremor is produced by the truck, which is transmitted through the ground to the house. Such a tremor is a small *earthquake*. When an explosion occurs in a factory, a violent tremor may be transmitted through the ground and through the air, so as to produce a marked shock even half a mile away or more. Such an explosion shattered many buildings in the city of Halifax in December, 1917. An actual earthquake shock is usually caused by the slipping of the rocks on one side of a fault. Owing to pressures within the earth, the strain along the irregular crack becomes greater and greater, until finally the jagged edges of rock fitting into one another across the crack give way, and the rocks on one side slip up or settle down as the case may be. The shock of the sudden slip sends a violent earth tremor out in every direction, and in the immediate neighbourhood of the fault the tremor may be so great as to destroy buildings, overturn railway trains, and hurl sand and dust into the air. After the earthquake that destroyed San Francisco had taken place, a fault was traced for over four hundred miles. Along this fault there was great disturbance. Roads and fences were dislocated where they crossed it, pipes and wires were broken, and there was every evidence of a violent upheaval.

Volcanoes

Sec. 113. Volcanic cones.—A volcano in the ordinary use of the term is a conical mountain at the top of which there is an opening, called the *crater*. This is the mouth of a duct, which leads down into the crust of the earth. The substances discharged from a volcano ascend through the duct and are driven out of the crater.

Sec. 114. Substances discharged from a volcano.—The two chief substances discharged from a volcano are melted rock and gases. The melted rock, which is called lava when in streams, usually does not overflow the lip of the cone but breaks through at a lower level and flows down the side. More frequently it is discharged, not in streams, but through the crater with explosive violence. Then it is blown into fragments, like water shot from a gun. The fine fragments are called *volcanic sand*, *ashes*, and *dust*, according to their size. Such fragments may be discharged in vast quantities

and thrown to great heights. The upper air currents catch this dust and may carry it hundreds of miles before it settles down. Although the term volcano is usually applied to a mountain which discharges lava from an opening, called a *crater*, it should, strictly speaking, be confined to the crater. The mountain is often younger than the crater and is built up by the lava and dust discharged from it. Volcanoes, then, do not necessarily occur in mountains at all but may break out at any weak part of the earth's crust, even though it be under the sea.

Sec. 115. Gases.—The chief gas discharged from a volcano is steam. It issues in vast quantities and condenses into a cloud over the mountain. At night the glowing lava in the crater below is reflected on the dense clouds above. This seems to indicate the presence of a fire, but there is usually nothing burning in a volcano.

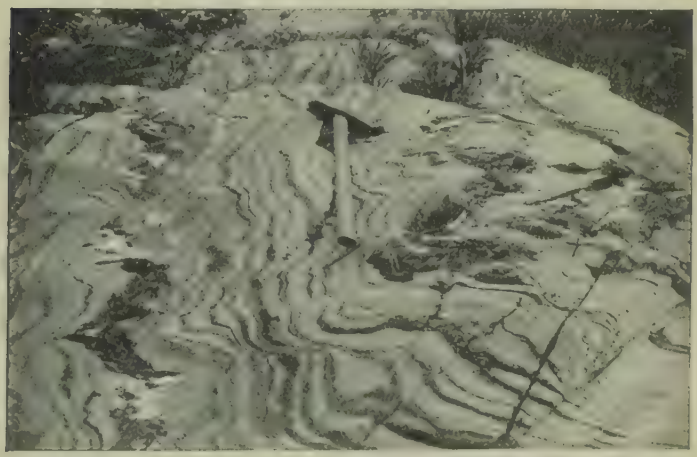
Sec. 116. Importance of volcanoes.—Volcanoes cause much destruction of property and loss of life and lay waste many regions for centuries, for lava is only very gradually weathered into soil. Volcanic ash, however, is very rapidly converted into soil suitable for cultivation. The lower parts of a volcanic cone, which is composed of ash, soon become green with vegetation, and farms and villages creep up the mountain side. When streams of lava weather, they make a very fertile soil, as the magnificent wheat fields and apple orchards of the States of *Washington* and *Oregon* bear testimony; for they are situated on decomposed lava beds.

Igneous and Metamorphic Rocks

Sec. 117. Igneous rocks.—Glass, which has the same components as are found in many rocks, is formed by the relatively rapid cooling of these components from a molten state. When lava cools rapidly it forms a glass-like rock. On the other hand, lava that is either covered over by a thick layer of solid rock, or is deep down beneath the earth's crust, cools and solidifies very slowly, sometimes taking thousands of years to do so. In such circumstances the substance formed is not glass-like, for the different components of the melted rock have time to collect in little crystals, and the solid rock produced is granular, the granules often being of different colours. Such rocks are called *granites*. The slower the cooling process the larger are the granules. Hence there are coarse-grained and fine-grained granites. Thousands of square miles of Northern Quebec and Ontario are covered with such rocks. Any rock formed by the cooling of molten material is called an *igneous rock*.

Sec. 118. Metamorphic rocks.—In ascending through ducts and

fissures and in flowing over the surface, lavas come in contact with the adjacent solid rocks. These latter are greatly heated by contact with the lava and are often at the same time subjected to great pressure and strain. Under such conditions the character of rocks is profoundly changed. Limestones become *marble* (Fig. 54), shales become *slates*, and granite becomes *gneiss*. These changed rocks are called *metamorphic rocks*.



[*From photograph of Geological Survey, Canada.*

FIG. 54. LIMESTONE METAMORPHOSED AND CONTORTED BY HEAT AND STRAIN

As the contorted lines were once straight, immense pressure, heat and strain were necessary to bring about the change. From Pontiac County, Quebec.

Sec. 119. Classes of rocks.—Thus we see that rocks are divided into three classes according to the way in which they are formed. Those like sandstone, shale, and limestone, which are consolidated sediments, are called sedimentary rocks; those like granite, which are formed by the solidification of molten rock, are called igneous rocks; and those like slate, marble, and gneiss, which are formed by the gradual changing of other rocks under the influence of heat and pressure, are called metamorphic rocks.

CHAPTER IX

MOUNTAINS, PLATEAUX, AND PLAINS

Mountains

Sec. 120. Volcanic mountains.—We have already described one method by which mountains are formed, namely, by volcanic eruption. A volcano may break out on a plain, a plateau, a mountain, or even under the sea. It begins immediately to build up a cone around it, and a mountain thus formed is readily distinguished from every other type, for this cone has a shape not produced by any other method of mountain building.

Sec. 121. Fault mountains.—Mountains are often formed by faults (Fig. 53). The strata are pushed up on one side of the fault, and the projecting surface is weathered and eroded, until a mass of material

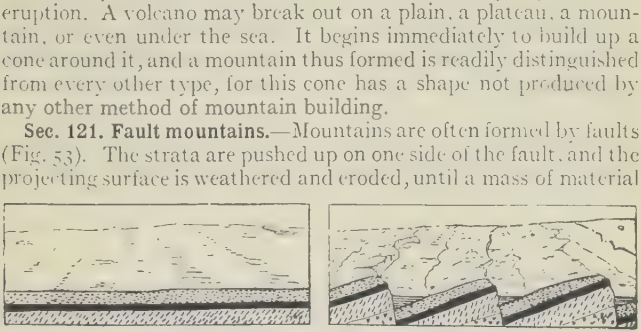


FIG. 55. ORIGIN OF FAULT MOUNTAINS

The first figure shows the horizontal strata before the uplifts. The second figure shows three faults producing three parallel fault mountains. What is the origin of the horizontal layers in the angles of the faults? Find the corresponding layers in the two figures, and describe the history of the region from the first to the second condition.

is deposited at the foot of what would otherwise be almost a vertical escarpment. Such mountains are called *fault mountains* (Fig. 55). The slope towards the fault is usually very steep, and the other slope is gradual.

Sec. 122. Folded mountains.—One of the commonest ways in which mountains are formed is by the folding of the strata. If a single fold is made, a single mountain will result, but if there are several parallel folds there will be several parallel mountains (Fig. 56). It is to be understood that the folding is very gradual, and that such mountains may take many thousands if not millions of years to form.

The great mountains of the world are formed by a very complex combination of the above methods. There are many faults and

many foldings, the latter being of the most varied kind. In the course of the elevation of the mountain many of the outer layers wear off the apex of the fold, so that the relationship of the strata on the two slopes becomes difficult to trace.

Sec. 123. Passes.—If a layer of soft rock runs across a mountain range, the crest at this point is worn down more rapidly than along the remainder of the range, and this gap becomes an easy passage across the mountain. Such a gap across the crest of a mountain is called a *pass*. The two most notable passes in the Canadian Rockies, the Kicking Horse Pass and the Yellowhead Pass, are both occupied by rivers. Low passes across mountains are of very great convenience to man.

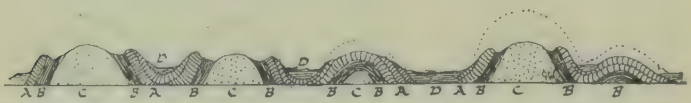


FIG. 56. SECTION ACROSS FIVE MOUNTAINS FORMED BY FOLDING OF STRATA

The dotted lines indicate the parts of the folds worn away. Which is the harder layer, A or B? What is the origin of D?

Sec. 124. Importance of mountains.—Mountains are probably the greatest barriers in the world. In early times the people of one valley knew scarcely anything about those living in an adjoining valley, because it was so difficult to cross the mountain between the two settlements. Even to-day mountains present the greatest obstacle to the construction of roads and railways.

The slopes of mountains cannot usually be cultivated. There is too much rock exposed, the good soil is washed away too readily, and the climate is often too cold, especially in the higher altitudes. Mountains, however, are often rich in minerals. The lower slopes are usually covered with forests, which yield lumber and pulp-wood. Moreover, the rivers flowing down the slopes have swift currents, rapids, and waterfalls, which can be used for generating electrical power. This is very valuable for running sawmills, factories, and other manufacturing establishments.

PLAINS

Sec. 125. Plains.—An extended region, which is comparatively flat, is called a *plain* (Fig. 130). Though the altitude of a plain is not usually great, it may have an average height of several thousand feet. For example, large parts of the Great Central Plain of North America are from 2,000 to 5,000 feet above sea-level. An extended tract of land of considerable height is frequently called a *plateau*.

A plateau usually has at least one edge steep and its surface is much rougher than that of a plain, as, for example, the plateau of British Columbia. The distinction, however, between a plain and a plateau is not well marked.

Sec. 126. Origin of plains.—We have already described how the flood-plain of a river is formed (Sec. 105) and also how at the mouth of a river a great plain, called a delta, may come into being (Sec. 121). Sometimes such deltas are thousands of square miles in extent. It is also quite possible for a lake into which rivers empty to be completely filled up with sediment and thus turn into a plain. Lake St. Clair offers a good example of this change in gradual operation (Fig. 47).

Any unevenness in the bottom of a lake is gradually filled up by the sediments washed down by the rivers. The same thing is true of that part of the bed of the ocean adjacent to the coast. Accordingly, the bottoms of such bodies of water are usually very flat. If a lake is drained or dries up, its bottom forms a very flat surface called a *lake plain*. The prairie region of Manitoba and part of Saskatchewan is such a plain. If for any reason there is an elevation of the sea coast or a depression of the coastal water, a strip of the sea-bottom along the coast is left bare and is called a *coastal plain*. Such a plain extends along the Atlantic coast of the United States from New York to Florida.

Sec. 127. Importance of plains. Plains are regions of dense population. There are several reasons for this. Most plains are composed of sediments, which are usually fine-grained, deep, and have much plant food in them. Accordingly they are easy to till, very fertile, and form the best farm lands in the world. Secondly, on account of their flatness, the soil is not easily washed away. Thirdly, they are well adapted for the building of roads and railways, since there are no hills to cut through and no rocks to be blasted. Fourthly, rivers flowing through plains have no rapids or waterfalls and hence are usually navigable. Thus excellent and cheap means of transportation are present to a greater extent in plains than in any other regions.

CHAPTER X

SHORE-LINES

Sec. 128. The effect of elevation and depression.—As the sediment brought down by rivers and the waste produced by wave action are deposited on the bed of a lake or sea, any hollows or trenches are levelled up. Thus the tendency is for the bottoms of lakes and seas to become even and regular. But the surface of the land, especially in its early stages, grows more and more irregular; for

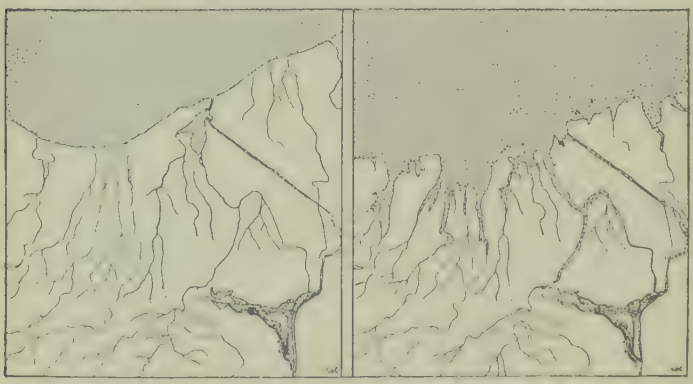


FIG. 57. A PART OF THE COAST-LINE OF LAKE ONTARIO IN LINCOLN COUNTY

On the left is shown the present coast line. On the right is shown the coast line as it would be if the water in Lake Ontario rose fifty feet. From the form of the present coast-line (on the left) is it a rising or a sinking coast?

as rivers flow over the land, they carve out gullies, ravines, and deep river-basins.

When the level of the sea rises, or the land is depressed, the water runs up into the river valleys to form long bays and leaves the higher intervening ridges as peninsulas. The water may even cross nicks in these narrow peninsulas, breaking them up into rows of islands. Thus an irregular shore-line is always produced by the sinking of a coast (Fig. 57). But when the water recedes from the land, either by the decrease in depth of the former or by the elevation of the latter, part of the flat bottom of the lake

or sea is exposed and the coast-line becomes comparatively straight and regular. The recent history of the coasts of the continents can be readily interpreted from the coast-lines. Northern, Eastern, and Western Canada all have very irregular coast-lines, with many bays, peninsulas, and islands (Fig. 58). Consequently we know that all these coasts have been recently depressed. Most of the coast-line of the Eastern, Southern and Western United States is regular, a fact which indicates that it has been recently elevated.

Sec. 129. Economic importance of the coast-line.—The nature of the coast-line is of great importance to man. Along a rising coast

FIG. 58. A SINKING COAST ALONG THE ATLANTIC

there are very few bays and peninsulas, and the water is so shallow, that it is difficult for ships to approach the shore. Consequently there are few good harbours, and sea transportation is seriously hindered. Such is the condition along the south-eastern coast of the United States. Again, a rising coast may be high and rocky, as when a range of mountains closely follows the coast. Such a condition makes the most inhospitable coast imaginable. Harbours are absent, and landing even from small ships may be very difficult. The western coast of the greater part of South America and Mexico is of this character. On the other hand a sinking coast has many long, deep, narrow bays, which make ideal harbours. Many harbours of this character are found on the coast of Canada both east and west.

PART II. COMMERCIAL GEOGRAPHY

CHAPTER XI

THE CEREALS

Sec. 130. Projects.—(*a*) Examine grains of wheat, oats, barley, and rye. Which have husks? Which is most like wheat—oats, barley, or rye? From which is the husk removed with the greatest difficulty? Compare a grain of pearl barley (barley bought in the grocery shop) with a grain of ordinary barley. What is the difference between the two? Compare a flake of rolled oats with a grain of oats. How could you convert the latter into the former?

(*b*) Grind up a handful of wheat, either with a mortar and pestle or by hammering it. Make it quite fine and then sift it through a piece of muslin. What does the product that sifts through resemble? What does the part remaining in the muslin resemble? What are the fundamental processes in making flour?

Sec. 131. Wheat.—The value of the wheat produced in the world is greater than that of any other grain. Moreover the amount produced is increasing rapidly. Yet one hundred years ago wheat was little known in parts of England, and in many parts of Canada and the United States, where rye bread was extensively eaten.

The wheat plant, like all the cereals, is a grass. Each grain, when it germinates, produces a single stem. But while this stem is still small, from six to twelve or more branches spring from its base. The number of these lateral branches largely determines the size of the crop, because each branch produces a head.

Wheat grows best on a fine, clay soil. In its early stages of growth it requires cool, wet weather, for this seems to stimulate the growth of the lateral branches. Later, when the heads form, it is necessary to have bright, warm, dry weather in order to produce the best quality of wheat. This grain requires a warmer climate than barley and oats.

The method of harvesting varies greatly in different countries. In parts of Russia, in Persia, and in other Asiatic regions, almost all harvesting operations are done by hand; on the other hand, in Western Canada and the United States great binders, that cut a swath of from 25 to 50 feet, are frequently used for harvesting the crop. Indeed, machines are used on the Pacific Coast of the United States and in Argentina that both cut and thresh the grain at the same time.

There are many varieties of wheat adapted to different con-

ditions of soil and climate. In the warmer regions of Canada wheat is planted in the autumn and grows above the ground before being covered by snow. In the spring growth is continued. When grown in this way it is called *winter wheat*. But since in Western Canada the extreme winter temperatures would kill winter wheat, the seed is not planted until the spring, and this crop is called *spring wheat*.

Wheat is largely used for making flour. The first stage in this process is the separation of the small and imperfect grains as *screenings*; the good grains are then crushed and ground between a series of rollers. The ground wheat is next sifted through very finely-woven silk cloth or *bolting-cloth*, leaving the husks or *bran*

FIG. 59. THE WORLD'S WHEAT PRODUCTION

Name the great wheat-producing regions. Which are the three chief wheat-producing regions of the British Empire?

and some of the coarser powdered grain known as *middlings*. The powder which passes through the cloth is the *flour*. The flour from *durum* wheat, which is grown largely in the United States and in Italy, is sometimes made into a dough, and passed through tubular presses to form *macaroni* and *vermicelli*. *Graham flour* is made by grinding the whole wheat grain, bran and all.

The chief countries which produce wheat are shown in Fig. 59. The industrial countries of Western Europe are the greatest importers of wheat, and of these Great Britain is easily first. She obtains wheat from every continent. America, however, supplying more than half. The quantity of wheat produced per acre in Great Britain is over 30 bushels, in Germany 24, in the United States 13, in Canada slightly less than 17.

[Courtesy of Bureau of Information, Queensland, Australia.

FIG. 60. A CORN FIELD, QUEENSLAND, AUSTRALIA

How many feet high are the corn stalks?

Sec. 132. Corn or maize.—The only cereal introduced from the New World to Europe is corn, or Indian corn as it is called, because it was cultivated by the American Indians when the continent was discovered. It prefers a warm, dry, mellow soil, with warm, summer weather for at least five or six months. Above all, the nights must not be cool. Hence Southern Ontario is the chief part of Canada in which it is ripened. During the growing period there must be frequent rains, but they must be so well distributed that the soil is never soaked for any length of time. The corn plant is much larger than that of any of the other cereals, for it reaches a height of from six to fifteen feet (Fig. 60). The grains are packed together round a central stem to form an *ear*. The ear

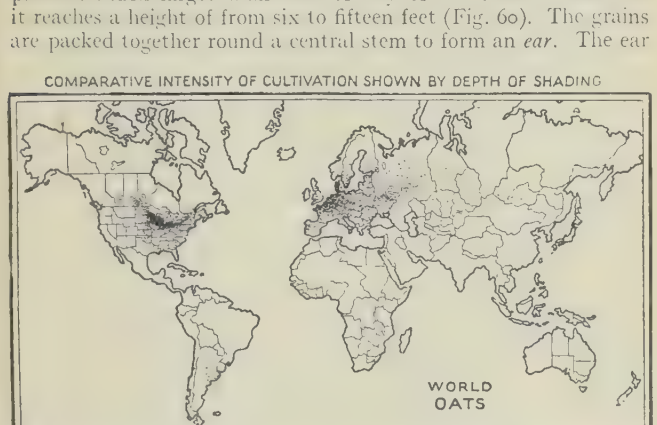


FIG. 61. THE WORLD'S PRODUCTION OF OATS

Name the chief producing regions. What country that produces much wheat (Fig. 59) produces no oats? Which has the more northern range, oats or wheat? Which grows nearer the Equator? Which thrives in the warmer climate?

may be more than a foot long and the grains vary greatly in size and shape. In colour they may be white, yellow, red, brown, or black.

The United States produces more than twice as much corn as the whole of the rest of the world. Northern Europe grows none, but Spain, Portugal, Northern Italy, and Rumania raise considerable quantities. It is the chief grain of South Africa, and Argentina raises it extensively.

Corn has more uses than any other grain. It can be ground into meal, which is made into cakes and porridge, but corn flour does not make good bread. Coarse corn meal mixed with water and boiled is called *hominy*. Corn is also cooked and eaten on the cob or cut from the cob, cooked, and canned. It is the principal food

of the Mexicans and is very largely used by the people of the Southern States. Its widest use, however, is as food for hogs, horses, and cattle. Moreover, the stems, either green or dried, form excellent fodder for stock. Corn-starch, corn oil, glucose, alcohol, and whisky are other products which are made from this grain.

Sec. 133. Oats.—There is a greater quantity of oats produced in the world than any other grain, but it is surpassed in value by other cereals. The plant thrives in cooler and moister climates than wheat, and hence it has a more northern range. It does not do well, however, in a hot, dry climate. All the northern countries of Europe produce it in larger quantities than wheat, and the same is true of Canada and the United States. It is by far the largest grain crop grown in Canada, which ranks as the fourth greatest producer in the world, being surpassed only by the United States, Russia, and Germany. France, however, is almost on an equality with Canada. Fig. 61 shows the world distribution of oats.

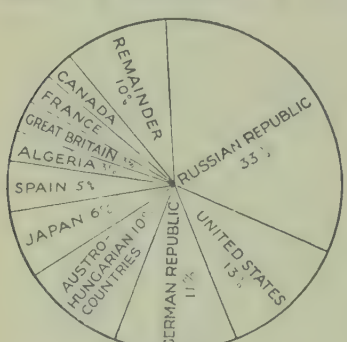


FIG. 62. WORLD'S PRODUCTION OF BARLEY

Though oats are most largely used as food for horses, considerable quantities are made into oatmeal and rolled oats, which are used to make porridge. The meal is also made into cakes, but since like corn it lacks gluten, a tenacious substance, it cannot be made into bread.

Sec. 134. Barley. — Barley grains are much like wheat in appearance, but they retain the husk after threshing. This grain has the widest climatic range of any cereal. It ripens under the midnight sun, 150 miles north of the Arctic circle, and it grows almost under the Equator in Eastern Africa.

It was the chief bread food of the Hebrews of Biblical times, and of the Greeks and Romans. It was also formerly used extensively in northern countries, but has been largely replaced by wheaten flour, as the latter makes the finest bread of any cereal. At present it is used for soups and broths in the form of *pearl barley*, which has the husk removed, and as food for pigs, sheep, and poultry. But it is principally employed in making beer. For this purpose the grains are allowed to grow for a couple of days, and then the germ is killed by heating the sprouting grain. In this state it is called *malt*. The malt is now ground up and dissolved in water, to which yeast and hops are added. The yeast

[*Courtesy of Illinois Central Railway.*

FIG. 63. WEEDING THE RICE FIELDS IN LOUISIANA

Under what conditions does rice grow? What kind of labour is used in the fields?

causes fermentation, which converts the mixture into beer. Barley is also used for making whisky.

Russia, including Ukraine, produces more than twice as much barley as any other country. The United States, Germany, and the Austro-Hungarian states come next. Canada stands eighth in order.

Sec. 135. Rye.—This is the cereal least known in America. The grain is much like that of wheat but is smaller. It is grown chiefly on soils which are too sandy and poor to produce wheat. Such a region extends from Holland, east through Germany and Central Russia, and this is the greatest rye-growing region of the world.

Rye bread or black bread, as it is called, is the chief food of the countries of Northern Europe. Of course, black bread is not really black, but slightly dark in colour, and is very nutritious, since rye flour is only second to wheat flour as a bread food. It is also used for making liquors.

Russia produces more than half of the world's supply of rye. Germany comes next, and then the Austro-Hungarian States.

Sec. 136. Rice.—The most important cereal of the tropics is rice, which is a great blessing to the dense populations of these regions, for the other cereals do not grow well in such warm climates, nor do they keep well in the heat and dampness of the rice-producing districts. Rice requires an average summer temperature of nearly 80 degrees. Besides, it requires a moist atmosphere for its full development. Most rice is planted in fields covered with several inches of water, and after it is a few inches long, the depth of water is increased (Fig. 63). When it begins to ripen, the water is drained off. Then the grain is cut and harvested like wheat. In some places the seeds are grown in seed beds and transplanted later.

Since rice stands for a great part of its growth in water, the fields are so moist after being drained that, usually, horse machinery cannot be used. Moreover, water has to be run on and pumped off at need. Consequently, much hand work is required for the farming of this crop, and it can only be grown profitably where there is cheap labour. Moreover, rice can only be raised on very flat regions, for only these can be easily flooded. Deltas and flood plains are especially suitable.

In India, China, Japan, and the East Indies, where rice is grown most abundantly, the methods and tools of cultivation and milling are very crude. On the other hand, in Texas and Louisiana it is grown on a firmer soil, which, when drained, can support the usual agricultural implements used for other grains (Fig. 64). As a result, one man can cultivate eighty acres, whereas, in China or India, one man can cultivate only about one acre. Consequently, in Texas and Louisiana it can be produced more cheaply than in China,

[*Courtesy of Illinois Central Railway.*

FIG. 64. A GOOD FIELD OF RICE IN LOUISIANA

How many feet high does the stalk grow? Is the head more like the head of wheat or of oats? Is the crop green or ripe? Is it standing in water or dry ground?

though the American labourer receives wages twenty times as high. After rice is threshed, it retains the husk, like barley and oats. The Chinese and Indians husk it only as they use it. Before it is exported to Europe and America, however, it is husked, the bran removed, and the grain polished and enamelled with

FIG. 65. THE WORLD'S PRODUCTION OF RICE

Name the chief countries which produce rice. What country in Europe grows rice? In the deltas of what rivers is it grown? Examine the rainfall map of Asia (Map 40 in Atlas) and decide whether heavy or light rainfall is required for its growth.

glucose and talc. The polishing removes a good deal of the most nutritious part.

Rice is the chief cereal food of more people in the world than any other grain, since Indians, Chinese, and Japanese use it largely. Much of the rice brought to Europe is used for making starch. The Japanese national drink is also made from rice. India produces by far the greatest quantity (Fig. 65), then China, followed by Japan and the East Indies.

CHAPTER XII

OTHER VEGETABLE PRODUCTS

Sec. 137. Projects. — (*a*) Examine packages of tea, coffee, and cocoa and find out, if possible, where the contents came from.

(*b*) Open out some tea leaves obtained from the tea-pot to find out what they are. Are they really leaves or parts of leaves? What are the stick-like substances that sometimes float on the surface of tea?

(*c*) Examine some granulated and some brown sugar under a lens. What is the shape of the grains of granulated sugar? How do they differ from the grains of brown sugar? Write out a list of all the uses to which sugar is put. Until about two hundred years ago sugar was unknown among Europeans and Americans. Name any substitutes that could be used to take its place for the purposes just named.

(*d*) Write out a list of all the uses to which India-rubber is put. Examine a piece of an old rubber or waterproof coat. Is there any woven fabric in it? Where is the rubber found in it? Examine oil-cloth. Is there any woven fabric in it? Where is the rubber found in it? Do you know of any waterproof fabrics that have no rubber in them?

(*e*) Examine a piece of wire such as is used in wiring houses for electricity. Of what is the outer part of the insulation composed? Remove this outer part and examine carefully the inner part of the insulation. Name two ways in which this inner substance (called gutta-percha) differs from India-rubber.

Sec. 138. Potatoes.—The most generally used vegetable in the world is the potato. It is a native of America, and after the discovery of this continent was slowly introduced into Europe. The range of cultivation is very wide, extending from sub-tropical regions to latitudes too cold even for barley. Potatoes do best on a sandy soil but grow well on any soil but stiff clay. They require much more labour than cereals in planting, cultivating, and harvesting; hence the world's acreage in potatoes is smaller than in cereals. But potatoes produce six times as many bushels to the acre. The potato is used chiefly as a food, being the chief support of a large part of the people of Germany and of Ireland. It is also

used as food for stock, and much starch is now produced from it. During the Great War the Germans made extensive use of *potato flour*, and it is possible that this product may have an extended use in the future. Germany grows about twice as many potatoes as any other country. It is followed by Russia and the Austro-Hungarian States (Fig. 208).

Sec. 139. Tea.—The tea plant is a shrub or small tree, which may continue to bear for fifty years. It requires warm summers with frequent rains, and grows best in a crumbly soil that is well drained. A hillside used to be considered best, but as long as it is well drained the land does not require a steep slope. Abundance of cheap labour rather than soil or climate determines the region of production, for the picking is all done by hand. After the picking, the leaves are allowed to wither and sometimes to ferment. The unfermented leaves are called *green tea*, the fermented *black tea*.

China was once the chief country of production, but now India, including Ceylon, takes the lead. China still holds the second place, and after China comes Japan, whence comes most of the green tea. Britain is by far the greatest importer of tea, and Russia before the Great War was the next in order. The other European countries use little tea. Britain seems to have given the tea-drinking habit to her colonies, for, if we except the population of Tibet and certain other countries of Asia, people of New Zealand and Australia are the greatest tea-drinkers in the world, even surpassing the British, and Canada is only a little behind the mother country in this respect. Then follow Russia and the United States, which, however, fall far behind, not consuming one-fifth as much per person as Canada.

Sec. 140. Coffee.—Coffee is strictly a tropical plant. Like tea it requires a warm temperature with abundant rainfall. It grows best on virgin forest soil and usually is cultivated at a considerable altitude. Like tea it is a small tree with long productivity. It does not begin to bear well until six years after planting, but it continues to bear for thirty or forty years, after which the soil becomes exhausted. The fruit is a red berry much like a cherry, except that it has two seeds instead of one. The seeds are the coffee beans of commerce. The berries are picked, the pulp removed, and the beans, which are still covered by a white coat, are dried. The white coat is next removed, and the beans are then packed in bags and shipped to market.

Brazil grows about three-quarters of the world's supply of coffee (Fig. 66). The other tropical countries of South and Central America and the West Indies are also large producers, as well as

Java in the East Indies. But strange to say, the regions in which coffee is grown use little of it as a beverage. The United States consumes about one-half of the world's supply. Each person in that country uses about twelve times as much coffee as a Canadian, while each Canadian uses almost six times as much tea as an inhabitant of the United States. England uses comparatively little coffee, but the Germans, Dutch, and Scandinavians drink it in large quantities.

Sec. 141. Cocoa.—Cocoa is a product obtained from the cacao tree, which must be distinguished from the cocoa-nut tree as well as from the coca plant, from which cocaine is obtained. The cacao tree is about twenty-five feet high and requires a very hot climate with abundant rains. It thrives best within fifteen degrees of the Equator. The tree begins to bear five years after the seed is planted, and it bears for about twenty-five years. The fruit is shaped somewhat like a very thick cucumber but is leathery and purplish-red in colour. It is picked from the tree, the husk is cut open, and the fifty or sixty seeds are withdrawn in a slimy mass. They are allowed to ferment, then dried, and finally shipped to be manufactured into cocoa and chocolate. To make *cocoa* the beans are roasted and crushed, the oil is expressed from them, and finally they are ground to a very fine powder. The expressed oil is called *cocoa-butter* and is used for making ointments. *Chocolate* is made by grinding the roasted beans without expressing the oil. The pasty mass is mixed with sugar and flavours and pressed into moulds.

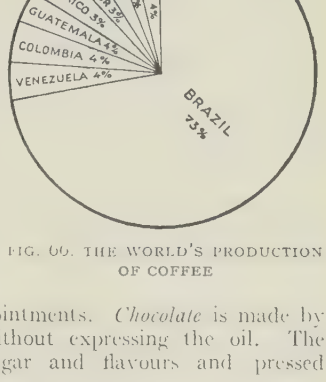


FIG. 66. THE WORLD'S PRODUCTION OF COFFEE

Ecuador has long occupied the first place as a producer of cacao beans, followed closely by Brazil. Within recent years, however, the West Coast of Africa and the adjoining island of St. Thomas have leapt forward and now rival Ecuador and Brazil.

In the consumption of cocoa the United States leads the world, with Germany and France second and third respectively.

Sec. 142. Tobacco. Tobacco, like the potato and cacao, was introduced from the New World to the Old. It is an annual plant,

[*Courtesy of Illinois Central Railway.*

FIG. 67. BUYERS ON THE LOOSE-LEAF TOBACCO FLOOR, KENTUCKY
The cured leaves are made into piles and are being examined by buyers.

which can grow in very diverse climates, having a range of 120 degrees of latitude, from 60 degrees north to 60 degrees south. But it cannot tolerate the slightest frost, and it thrives best in a tropical or sub-tropical region with comparatively dry climate. The plant matures in about four months from the time of seeding. Tobacco-raising involves much labour, for the seedlings must be transplanted, and the soil requires constant cultivation. When the plant matures, the leaves are carefully pulled, allowed to wilt, and are then dried in barns, often by means of artificial heat. The tobacco is then piled in heaps to ferment (Fig. 67). The quality of the leaf differs greatly in different regions, the character of the soil appearing to have a special influence on the quality of the product.

Tobacco is used for smoking, chewing, and for making snuff. A small quantity is used in making washes for killing harmful insects. The United States produces the greatest quantity, Kentucky, North Carolina, and Virginia being the chief tobacco states. Next to the United States comes India, followed by Russia. Cuba in the West Indies produces the best tobacco. Fig. 68 shows its distribution.

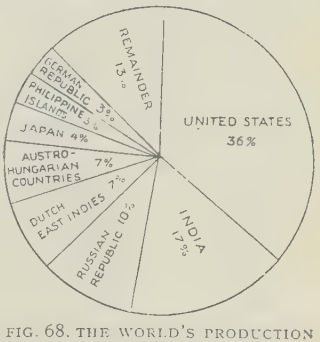


FIG. 68. THE WORLD'S PRODUCTION OF TOBACCO

Name the chief tobacco-producing countries in order.

The Belgians are most addicted to the tobacco habit, each using on the average over six pounds per year; the United States is next to Belgium with a yearly average of three and a half pounds.

Sec. 143. Sugar.—Sugar is the cheapest of all the luxuries that we use; in fact it would be considered a necessity even for the poorest. Yet it is a comparatively recent product, for three hundred years ago it was almost unknown in Europe or America. It is obtained from several plants, such as the sugar-cane, sugar-beet, maple, sorghum, and palm.

The sugar-cane is a grass-like plant from ten to fifteen feet high. A number of stems grow out from a swollen base each spring, and are cut off when mature. The plant continues to bear for thirty years, and the crop needs little or no attention. For proper growth it requires a moist soil and a warm, tropical climate.

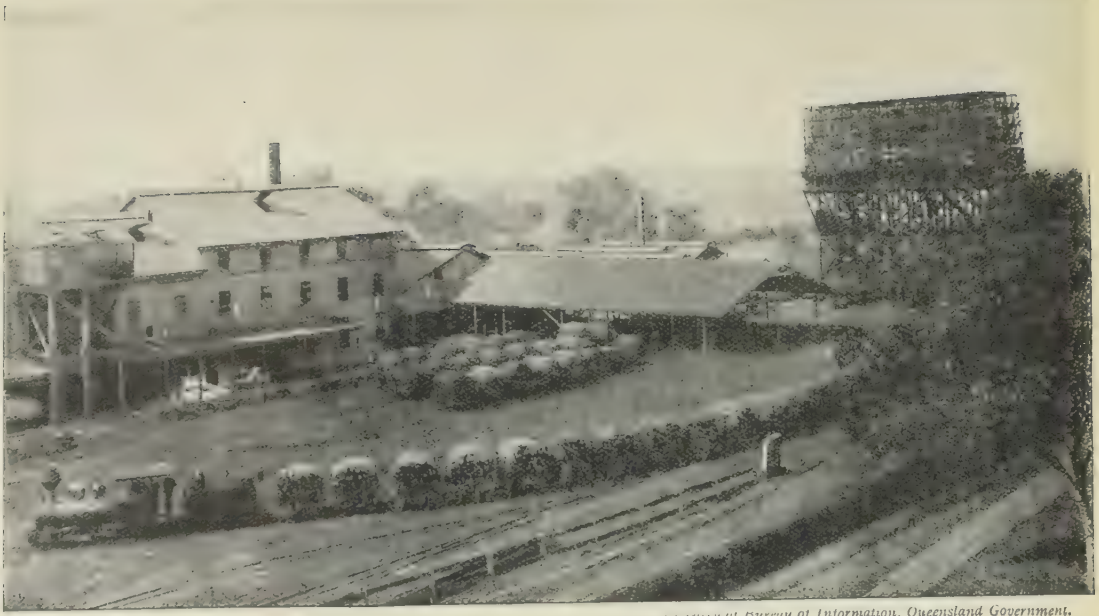
The stalks of sugar-cane are passed through rollers, which crush them and express the juice. The juice is purified, then the water evaporated until the crystals of sugar form. These are surrounded by a liquid, which is separated from them in a whirling-machine, just as cream is separated from milk. Such crystals form *raw sugar*, while the separated liquid is called *molasses*. The raw sugar is then shipped to various countries, where it is manufactured into *refined sugar*. This industry is carried on extensively in different parts of Canada.

Beet-sugar differs little from cane-sugar in the processes of manufacture, but the crop from which it comes is entirely different. The sugar-beet resembles a turnip or mangold, and requires similar soil and climate, though it is much more sensitive to frost. It requires much more attention than sugar-cane, for besides the annual planting, the crop has to be thinned, weeded, and hoed. Further, sugar-cane grows in countries where labour is cheap, and it produces a larger yield of sugar to the acre. Nevertheless, the beet industry is more than holding its own with the cane industry. This is due to several facts. Sugar-beets are grown in the temperate zones, in the midst of dense populations, where it finds a ready home market; sugar-cane is grown in the tropics, far from the chief consuming countries. Another and perhaps the chief advantage of the beet-root industry is the efficient machinery which has been invented for the process of its manufacture. Moreover, the refuse from the sugar-beet forms a valuable food for stock, while the crushed cane can be used only for fuel. Yet in spite of these advantages more sugar is still produced from the cane than from the beet.

Sugar-cane is produced in large quantities in India, but the greater part of this output is consumed locally. Cuba is the greatest producer of cane-sugar followed by Java, Hawaii, and the United States in order. Almost all tropical countries produce some sugar-cane. Sugar-beet is cultivated most largely in Russia, Germany, the Austro-Hungarian States, the United States, France, Holland, and Belgium (Fig. 208). A certain amount of this crop is raised in Ontario.

In Eastern Canada sugar is obtained from the sap of the sugar-maple. The trees are tapped in the spring, before the leaves are open, and the sap is boiled down into *maple syrup* and *maple sugar*.

Sorghum is a tall grass-like plant used chiefly for fodder, but sugar and syrup are extracted from its cane. The largest cultivation of sorghum occurs in the United States, but some of it is grown in Ontario.



[Courtesy of Bureau of Information, Queensland Government.

FIG. 69. A SUGAR MILL IN QUEENSLAND, AUSTRALIA

Notice the canes in bundles on small cars.

Sec. 144. India-rubber or caoutchouc.—This well-known substance is obtained as a milk-like liquid, which exudes from the wounded trunks of certain trees. Every one knows that when the stem of a dandelion or milkweed is broken, a milky fluid comes out. The raw rubber, as it exudes from the trees, is somewhat similar. It is collected in vessels, and some sour substance like vinegar or lime-juice is added to curdle it. The curd is worked into a solid mass, and exported as *raw rubber*. The raw rubber is usually mixed with sulphur to make *vulcanised rubber*, which can be brought to any degree of hardness according to the quantity of sulphur added.

Rubber is only a recently discovered commodity. At first it was used chiefly for rubbing out marks made by a lead-pencil. This use gave it the name of rubber, and from the principal source of supply in those days it got the fuller title of India-rubber. In 1823 a man named Mackintosh found that it could be made into a cloth, hence the name of mackintosh for a rubber coat. Now rubber is used for many other purposes, the chief of which is the making of tires for automobiles and bicycles.

The rubber-producing trees grow wild in tropical countries. Along the Amazon River and its tributaries the largest quantity of wild rubber is collected. An inferior rubber is obtained wild in Central Africa; but the chief sources of rubber at present are the rubber plantations of Ceylon, Malay, and the East Indies.

The United States uses almost half of the total rubber produced in the world. Great Britain comes next, followed by Germany.

Sec. 145. Gutta-percha is a commodity that must not be confused with India-rubber. It is likewise the milky juice of a certain tree from the East Indies. To obtain the milky juice or latex the tree is cut down.

Gutta-percha is not elastic like rubber, but pliable like putty, so that it can be moulded into any form. It is a good non-conductor for electricity, and this property, with its pliability, determines its chief use, namely, the insulation of electric wires.

Sec. 146. Tapioca, sago, and arrow-root. Tapioca is made from a starch, called *cassava*, which is extracted from the roots of a shrubby, tropical plant extensively cultivated in tropical America, Africa, and the East Indies. The starch is slightly wetted and collects into little masses, familiar to us as tapioca.

Sago is obtained from the pith of a palm tree, which grows

extensively in the East Indies. The tree is cut down just before the fruit ripens, the pith removed, grated, and the sago extracted by water. Borneo exports a great deal of this substance.

Arrow-root is a starch extracted from the swollen underground stems of several tropical plants. The West and East Indies are the chief sources of supply.

CHAPTER XIII

FABRICS

Sec. 147. Projects.—(*a*) Separate the threads of a piece of cheese-cloth in order to learn how it is woven. Describe the relation of the threads to one another. Examine pieces of coarse linen, flannel, and silk to find if they are woven in the same way.

(*b*) Examine carefully a thread taken from the cheese-cloth. Of what is it composed? What is done to the parts of which it is composed, in order that they may hold together to make a strong thread. Examine threads taken from flannel, linen, and silk fabrics to find if they are also composed of fibres twisted together. What name is given to the process of making fibres into thread? Which of the threads, silk, woollen, cotton, or linen, seems to be composed of the longest fibres? Which has the most curly fibres?

(*c*) Examine a piece of printed calico, or print, as it is called. Does the design appear on each side? Pull out some threads to find if it is woven of differently coloured threads. How do you think the pattern was produced? Next examine other pieces of cloth with designs on them, and, by pulling out the threads, try to find the various ways in which coloured patterns are formed.

(*d*) Examine a piece of velvet to find out how the pile is obtained.

(*e*) Burn pieces of cotton, linen, silk, and woollen cloth. Which blaze in the fire? Which smell somewhat like burnt sugar? Which smell more like burning leather? How could you tell whether a fabric were cotton or woollen? Silk or cotton?

Sec. 148. Cotton.—Cotton is probably the most important article of commerce in the world, its only possible rival being wheat. It is grown as an annual and thrives in a tropical or sub-tropical climate. It requires a long summer, moderate but not excessive moisture, and a dry, warm soil. Above all it is extremely sensitive to frost, and since it requires seven months to mature, its region of growth is strictly limited.

It is planted in rows and kept well hoed. It flowers about three months after planting, when a pod appears, which, as it ripens,

[*Courtesy of Illinois Central Railway.*

FIG. 70. A COTTON GIN IN THE STATE OF MISSISSIPPI

What is there in the wagons? What is done to the cotton at the gin? What animals are used for pulling the wagons?

[*Courtesy of Illinois Central Railway.*

FIG. 71. UNLOADING BALES OF COTTON FROM A STEAMER AT NEW ORLEANS

Are the men unloading the cotton white or black? What are the dimensions of a bale of cotton? How deep is the boat in the water? Where do you think the boat came from? Where is the cotton probably going?

breaks open, exposing a mass of seeds, each of which has a tuft of white fibres on it. These fibres are the part used for making the cloth. As in the case of the tomato, flowering and fruiting continue until the plants are destroyed by frost.

Picking of the cotton begins in August and continues for about one hundred days until it is put an end to by frosts. The picking is the most expensive part of the work, as it has to be done by hand. Negro women and children are engaged for this purpose in the Southern States. The seeds with their attached fibres are put into baskets. One hundred pounds is an average day's picking.

The next stage is the removal of the fibre from the seed. This process is called *ginning* (Fig. 70). Formerly done by hand, it is now carried out by machinery. The part separated from the seed is called *lint*. It is packed in bales and shipped to be manufactured (Fig. 71).

The seeds were formerly thrown away, but every part of them is now used. They are first husked, i.e. the seed-coat or husk is separated from the kernel. The husk is made into paper, fed to stock instead of hay, or used as a fertilizer. From the kernel is expressed large quantities of a very valuable oil, called *cotton-seed oil*, which is used in making oleomargarine and shortening for cooking. It is also used for making soap and as a substitute for olive oil.

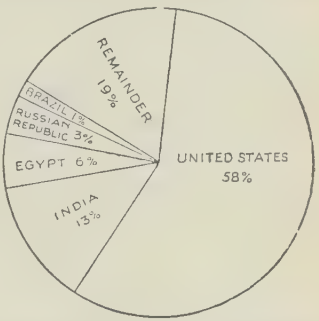


FIG. 72. THE WORLD'S PRODUCTION OF COTTON

Name the four chief cotton-producing countries.

The kernels, after the oil is expressed, are used for making *cotton meal*, which is an excellent and nutritious food for cattle and also a good fertilizer.

The United States grows more than three-fifths of the cotton of the world (Fig. 72). Texas produces far more than any other state. India comes next to the United States as a producer of cotton, and then Egypt, where the cotton is of very fine quality. Almost every country of the world between 43 degrees north latitude and 33 degrees south latitude produces some cotton.

Sec. 149. Cotton manufacturing.—The manufacture of cotton and other fabrics consists of two main processes, *spinning* and *weaving*.

Spinning is the making of the fibre into continuous threads called *yarn*. This is done by machines that gradually twist the mass of fibres tightly into a thread. The longer the fibres, the stronger the thread produced. In weaving, the yarn is stretched on a frame to form a fabric; this consists of two series of threads attached to the sides and ends of the frame and crossing each other at right angles. The longer threads are called the *warp*, those crossing them are called the *weft* or *woof*. Weft is passed alternately under and over the woof to form the cloth.

The variety of cloths produced from cotton is very great. *Calico, printed calico* or *print, muslin, canvas, cambric, flannelette*, and

FIG. 73. THE FLAX ACREAGE OF THE WORLD

What provinces of Canada grow flax? Name the countries of Europe that grow flax extensively. Does it grow under wide or narrow ranges of climate?

duck are some of the most common. Cotton is more extensively used for clothing than any other fabric, and its use for this purpose is rapidly increasing.

Britain has been the outstanding manufacturer of cotton goods for a century, as all important machines used for spinning and weaving are the work of British inventors. But within recent years, Germany, Russia, the United States, and France have also become large manufacturers of cottons.

Sec. 150. Linen is a fibre obtained from the flax plant, which grows through a range of climates extending from India to the Canadian Prairie Provinces. Russia grows about twice as much

flax for fibre as all the rest of the world, and Poland and Ukraine stand next (Fig. 73). Flax requires a firm, moist soil. The plant is branched, grows two or three feet high, and has a beautiful blue flower. When it is grown for the fibre, the seeds are planted close together, so that there will be little branching and so that the stem will be very high, thus producing a long fibre. Under this system of cultivation the seed must be sown broadcast; moreover, when the plants are a few inches high they must be hand-weeded, which is a long, tedious task; finally, when ripe, the plants cannot be cut, but must be pulled up by the roots. Hence it will be seen that this variety of crop requires much hand work, and can be profitably grown only where labour is cheap.

In order to get out the fibre from the stem, the latter is soaked in water until it is softened; then it is crushed between rollers, and the broken wood separated from the fibres. These fibres are next spun and woven into linen. This fabric is a beautiful and strong white cloth, with a handsome, glossy lustre. It is used for the finest garments, and its rags make the best paper. The North of Ireland is the greatest centre for the manufacture of fine linen goods, but France and Russia are important rivals.

In some countries, for instance Argentina, India, the United States, and Canada, flax is grown for the seed. From the flax-seed or linseed we obtain *linseed oil*, which is invaluable for mixing with paints. After the oil is expressed the seeds are made into *oil-cake*, which is a very nutritious food for stock.

Sec. 151. Hemp.—This plant grows in the same countries and under the same conditions of climate and soil as flax. In Russia, Italy, and France it is grown chiefly for its fibre. Hemp fibre is contained in the inner bark of the stem and is separated in the same manner as linen fibres are separated from the stem of the flax. But hemp fibre is usually much coarser than linen and is used chiefly for making rope and the coarsest kind of canvas. The fibres of several other plants are called hemp. *Manila hemp* comes from the leaf-stalks of a plant that grows in the East Indies. It is unrivalled for the making of ropes and is largely used in making binder-twine. Old Manila ropes are used for making *Manila paper*. *Sisal hemp* is the fibre from the leaf of a Mexican plant. It also is used for cordage and binder-twine, especially when mixed with the superior Manila hemp.

From the hemp plant are obtained, besides the fibre, certain liquors much used in India. In the same country the leaves, called *bhang*, are smoked by the natives. The seeds make excellent food for cage-birds and are also crushed for their oil.

Sec. 152. Jute.—This fibre is obtained from the inner bark of a plant chiefly grown in Northern India. It is used principally for

making a coarse canvas for covering bales of cotton or furniture, and also for making bags. *Dundee* in Scotland is the greatest centre for the manufacture of jute cloth.

Sec. 153. Wool.—The fabrics described up to the present are vegetable products, but wool is an animal product. It is a peculiar hairy covering of several animals. There are two features which distinguish a wool fibre from an ordinary hair: (1) the wool fibre is much curled or crimped, so that it can be stretched to several times its natural length, and when it is released its elasticity causes it to shorten again; (2) its surface, when looked at through a microscope, is covered by projecting scales, which overlap like the shingles on a roof. Both these characteristics are very important, for they cause wool to felt easily, so that it may readily be spun into yarn; and they make woollen clothing very elastic. Most wool is obtained from sheep. These animals thrive on land so bare that cattle would starve on it. The sheep producing the best wool is the *merino*. It has been introduced from Spain into all the great sheep-producing countries, such as Australia, New Zealand, South Africa, and Argentina. But as the best merino sheep are small and not good mutton-producers, they have been less extensively reared since mutton-raising became profitable.

Wool is obtained from goats, alpacas, and camels, as well as from sheep. From the Angora goat of Asia Minor comes a wool used for making *mohair*, while from the Cashmere goat of Northern India we get the wool used for weaving the beautiful *cashmere shawls*. The alpaca is an animal like the llama and lives in the Upper Andes Mountains. Coarse cloth is woven from its hair. Camel's hair is used for making fine brushes, and, mixed with other fabrics, is also woven into shawls, carpets, etc.

Australia raises more sheep than any other country, and the wool is of a good quality. It ships most of its clip to Great Britain. Argentina comes next to Australia as a wool producer. Its wool is not so clean as that from Australia and is largely sent to the continental countries of Europe. The South African wool is not of so good a quality as that of either Australia or Argentina (Fig. 74). The wool clip of the United States is very large but of an inferior quality. British sheep produce a beautiful, long, lustrous wool.

Sec. 154. Woollen manufacture. The woollen fibre, like that of cotton and linen, has to be first spun and then woven. It is spun into two distinct kinds of yarn, one called *worsted*, the other *woollen yarn*. To produce worsted the long wool fibres are combed until they are parallel and then spun into a fine hard yarn. In the production of woollen yarn the short wool-fibres are used, and instead of being combed parallel, are made into a felted mass,

[*Courtesy of South African Railways.*

FIG. 74. WOOL MARKET, PORT ELIZABETH, SOUTH AFRICA

in which the fibres run in all directions. This process is called *carding*. The mass is made into strips, which are spun into soft, loose yarn. One of the chief cloths woven from worsted yarns is *serge*, while *broadcloth*, *tweed*, and *flannels* are made from woollen yarn.

Britain still leads the world in the manufacture of woollen goods, especially worsteds. But Germany, France, Czecho-Slovakia, Austria, and the United States of America also produce woollen fabrics on a large scale.

Sec. 155. Silk. –This fibre, like wool, is an animal product. It is formed by the caterpillar of a large and beautiful moth. The caterpillar lives on the leaves of the *mulberry tree*, and since the insect is reared indoors, the possible range of silk production is determined merely by the presence or absence of a soil and climate suitable for the growth of the plant. Since this is fairly hardy, it can be cultivated as far north as Japan.

The eggs are hatched and the caterpillars raised in sheds, where they are fed on mulberry leaves, which are pulled from the trees for the purpose. The caterpillars grow very rapidly, and if the sheds are kept sufficiently warm, reach their full size in seven weeks. They then crawl up on a piece of brush and weave a cocoon about themselves. This cocoon is made of a substance which exudes in two sticky strands from the forehead of the caterpillar. These two sticky strands at once unite into a single fibre of silk, which joins with other fibres to form the cocoon.

The unwinding or *reeling* of the silk from the cocoon is a business that requires great carefulness and delicacy of touch. The skilled silk winder must have the experience born of early training, long practice, and several generations of predecessors. Hence silk culture does not readily start in new regions.

The process begins with the placing of the cocoons in warm water to soften the gum, which holds the fibres together. Next, the gummy fibres from several cocoons are pressed together and then wound on a reel, where they adhere to form a single thread. A single cocoon may produce a fibre more than half a mile long. The skeins of silk are fastened together to form *hanks*, and these are packed and shipped to be manufactured. In this form it is called *raw silk*.

The chief producers of raw silk are Japan, China, Italy, and France.

Sec. 156. Silk manufacture.– The threads of raw silk, being very long, do not require spinning, but are too fine for weaving. Several fibres are therefore put together and given a twist, which is called *throwing*. The gum is next taken off the fibres by boiling them in a soapy solution, and the threads are then ready to be woven.

Silk, satin, and velvet are the chief kinds of cloth made of silk, though imitation satin and velvet are now manufactured from cotton.

The United States is the greatest manufacturer of silk. France comes second and Germany third. Formerly, France was by far the greatest manufacturer. But strange to say, the invention of the sewing-machine deprived her of her supremacy. She used to manufacture a very superior and expensive class of silk dress goods which ladies greatly favoured. But with the coming of the sewing-machine, rapid and cheap dressmaking was introduced, and with it a rapid change of fashions. Hence ladies preferred a cheap silk dress-goods and frequent changes, rather than the more beautiful and durable fabrics, which were the pride of French manufacturers. Consequently the French industry languished. But recently France has adapted herself to the manufacture of the cheaper class of goods, and is now only surpassed by the United States in silk manufacture.

CHAPTER XIV

FRUITS, NUTS, AND SPICES

Sec. 157. Projects.—(*a*) Examine the printing on packages or boxes of dates, figs, raisins, and currants, on the wrappers of oranges, lemons, and grape-fruit, or better, on the boxes in which they were packed, and on a bottle of lime-juice, in order to find out from what part of the world these products come.

(*b*) Soak a raisin, a currant, a prune, and a fig in tepid water. What common fruits do the raisin, currant, and prune resemble? Examine the seeds of the raisin and compare them with those of the grape. Cut the fig from end to end. Is it hollow? Is there an opening in the top of it? Compare it in these respects with the fruit of the wild rose.

(*c*) Examine the following spices: Nutmeg, whole cinnamon, whole black pepper, cloves, whole ginger, allspice, carraway, and vanilla pods. Soak the pepper, cloves, nutmeg, and allspice in water until they are soft, then cut them across in order to study their structure. Which is a piece of bark? Which is an unopened flower? Which is a nut? Which are dried berries? Which is a fleshy root? Which is a pod?

Sec. 158. Citrus fruits.—Under this heading are included the orange, lemon, grape-fruit, and lime.

The *orange* grows chiefly in the warmest part of the temperate zone. The plant is a wide leaved evergreen tree about thirty feet high. A single tree bears from five hundred to one thousand oranges in a season, and continues to bear abundantly for from fifty to eighty years. The oranges are picked quite green, wrapped in paper, and packed tightly in boxes so that there will be no shaking during transportation (Fig. 75).

There are three chief kinds of oranges, the *sweet orange*, the Seville or *bitter orange*, which is used for making marmalade, and the *tangerine*, which is very small, juicy, and sweet.

Oranges are grown largely in California, Florida, Mexico, and the West Indies in North America, and all around the Mediterranean Sea in Europe (Fig. 76).

Lemons grow on more straggling and smaller trees than oranges. But they require much the same conditions of climate, although the lemon tree is more delicate. The raising of lemons is more profitable than that of oranges, as lemons can be kept for a much

[*Courtesy of Citrus Fruit Growers' Association of California.*

FIG. 75. SORTING, WRAPPING, AND PACKING ORANGES FOR SHIPMENT

Notice that the oranges roll along the central trough and the different sizes fall into separate bins.

longer period. They are picked green and packed and shipped like oranges. They are grown in all warm temperate and semi-tropical countries, Italy being particularly noted for its large production.

The juice of the ripe lemon is used as a flavouring in various drinks, salads, and other dishes. An extract called *essence of lemon* is obtained from the skin, which is also candied and used in making cakes and puddings. Candied citron peel is made from the fruit of a very similar plant.

Lime-juice, which is such a refreshing drink in hot weather, is expressed from the *lime,* a very sour fruit resembling a small lemon.

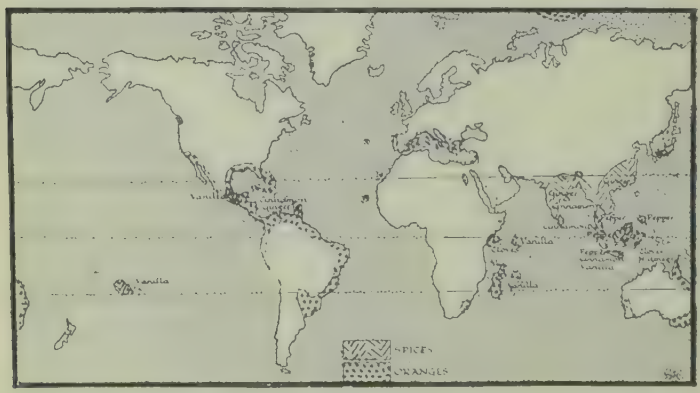


FIG. 76. WORLD DISTRIBUTION OF ORANGES AND SPICES

Are all the spices obtained between the tropics? Do oranges grow chiefly in the tropics or in the warm temperate zone?

The tree is grown chiefly in the West Indies and especially on the island of *Montserrat.*

The *grape-fruit* or *shaddock* is like a very large orange, lighter in colour and much more bitter. It is extensively grown in Florida and has of late years become a very popular fruit. It is eaten raw or made into marmalade.

The pine apple, though not a citrus fruit, grows in many of the same regions. It requires a warmer climate than does the orange or lemon. The plant has a short stem and a crown of stiff leaves with a fruit at the centre. It is grown in Florida, the West Indies, South Africa, Northern Australia, and many of our Canadian pine-apples come from Hawaii (Fig. 77).

Sec. 159. Fig.– This fruit grows on a tree about twenty feet high. It has a slightly wider range than the orange, not being so sensitive

[Courtesy of South African Railways.

FIG. 77. A PINE-APPLE FARM IN SOUTH AFRICA

to frost. The fruit is picked by hand, dried in the sun, then packed in boxes, barrels, or baskets, and shipped. The drying and packing requires much hand labour, therefore figs can be profitably grown only where labour is cheap.

The Eastern Mediterranean Coast, and especially Asia Minor, is the chief district where figs are grown, the best kind coming from *Smyrna*. They are an important part of the food of the natives of Western Asia and Southern Europe. Figs have been recently grown in British Columbia.

Sec. 160. Currants and raisins are simply dried grapes. These particular grapes, owing to the climate and soil in which they are grown, are unsuitable for making wine. The grape from which

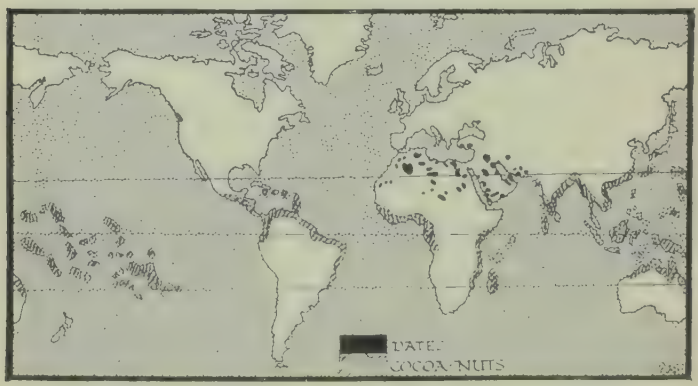


FIG. 78. WORLD DISTRIBUTION OF DATES AND COCOA-NUTS

raisins are made is cultivated on the Mediterranean coasts, Spain producing the finest. *Sultanas* are made by drying seedless grapes, which grow only in Asia Minor, and currants by drying somewhat similar small seedless grapes, which thrive nowhere but in parts of Greece. The name currant is derived from Corinth, a Grecian city.

Sec. 161. Dates. — This fruit grows on the date palm, a magnificent tree eighty feet high, which thrives in the oases of the great desert stretching across Northern Africa and Arabia. In Arabia the date palm is the chief source of national wealth, and its fruit is the staple food of the poor. The fresh fruit is much more delicious than the dried dates which are exported (Fig. 78).

Sec. 162. Banana. — This fruit grows on a leafy-stemmed plant about fifteen feet high. It requires a hot, damp, tropical climate. The fruit grows in a great bunch from the crown of the plant, which

droops with the great weight of the cluster. The varieties that may be eaten raw are called *bananas*; those that require cooking are called *plantains*. Although these latter are almost unknown in Canada, they form a much more important article of food in tropical countries than the banana. The fruit of the banana-plant is dried to make *banana meal*, which is an important food-stuff in some parts of the world.

The supply of bananas for Canada and the United States comes chiefly from Jamaica.

Sec. 163. Olive. -This plum-like fruit grows on a tree from twenty to thirty feet high. The fruit is picked either green or ripe. The green fruit is soaked in lye, in order to extract the oil, and is then put into brine. In this form it is used as a relish at meals. The ripe fruit is also used for eating, but more commonly *olive oil* is expressed from it. This is an important article of commerce. It is used as a salad oil, as a medicine, external and internal, and for making soap. The genuine *Castile soap* is always made by the action of lye on olive oil.

The olive flourishes in Mediterranean countries, the most productive being Italy. It is now cultivated in many of the warm temperate regions of both the Old and New World, especially in those parts having dry summers.

Sec. 164. The vine.—When we speak of the vine, we mean the grape-vine, which is cultivated for the production of wine. The limits of the growth of the vine are determined by the fact that it takes a warm summer of considerable length to ripen the fruit. A warm September is essential, and abundant sunlight is required to make the grapes sweet (Fig. 79).

The grapes are picked by hand and the juice expressed. This is frequently done by treading on them with bare feet. The expressed juice, which is called *must*, is now allowed to ferment. During this process, which may continue for months, a crust settles to the bottom from which *cream of tartar* is obtained.

There is a great difference in the quality of the wines produced in different regions: *claret*, *burgundy*, and *champagne* come from France, *sherry* from Spain, and *port* from Portugal. France produces most wine, Italy comes next, and is followed by Spain and Portugal. In North America the best wine is made in California. Great producers are usually great users. Although France makes so much wine, she nevertheless imports large quantities of it, for the French are the greatest wine-drinkers in the world, each person on the average consuming about thirty gallons a year. In Italy the people consume about twenty-five gallons apiece, while in the United Kingdom each person consumes on an average less than half a gallon.

[Courtesy of West Australian Government.

FIG. 79. GRAPE-VINES RUNNING ON A TRELLIS-WORK

This is a West Australian scene. Notice the great number of large bunches of grapes hanging from the arch of the trellis.

Sec. 165. Nuts.—The cocoa-nut palm is a graceful tree from sixty to a hundred feet high, which grows throughout the tropics, thriving especially on the sea-shore. Each tree ripens about sixty nuts per year. The nut is an important source of food in many Pacific islands. The kernel of the nut is cut into small pieces and dried for shipment to Europe. Oil, which is used for making candles and soap, is expressed from these dried kernels, which are called *copra*. The natives of the regions where the tree grows make much use of the leaves and wood of the trees as well as the husks of the nuts.

The *peanut*, or *ground nut* as it is called in Britain, is an annual and trails along the ground. After the flower withers, the young fruit is forced under the ground, where it matures. It yields a heavy crop, often reaching thirty-five bushels to the acre. The raw nut is much eaten in tropical countries, and the roasted nut is very popular as a sweetmeat in Canada and the United States. Large quantities of the nuts are brought from tropical countries to Europe, where the oil is expressed from them.

The *almond*, which grows in Southern Europe, consists of two varieties, the sweet and the bitter: the first is used as a sweetmeat, the second for flavouring.

Brazil-nuts grow in tropical America on lofty trees, often 150 feet high. The globular fruit, six inches in diameter, falls to the ground when ripe. The natives break it open and from each husk obtain from eighteen to twenty-five nuts. These are much used as a sweetmeat, and a fine oil is expressed from them, which is used for cooking and for oiling watches.

The *walnut tree* and the *hickory tree* are natives of Canada and the United States, and the *English walnut tree* is a European species. The *pecan* is really a species of hickory-nut, which grows in the Western and Southern United States.

The *hazel* or *filbert* and the *chestnut* are produced chiefly in Southern Europe. Hazel-nuts are grown to a certain extent in the United States also.

Sec. 166. Pepper.—There are several kinds of pepper. *Black pepper* is the dried berry of a climbing vine, which is picked before it is ripe. To obtain *white pepper* the same berry is allowed to ripen, the skin and pulp are removed, and the seed is dried. Black and white pepper are usually ground before they are used. The greatest quantity of pepper is grown in the East Indies and Malay; some comes from the West Indies (Fig. 76). *Cayenne pepper* is an entirely different substance. It is the ground pod of a plant, which is grown in the same regions as the other kinds of pepper.

Sec. 167. Cinnamon is the inner bark of the younger branches of a small tree. The best quality and the largest quantity comes

from Ceylon. Inferior cinnamon is grown in the West Indies and Brazil (Fig. 76).

Sec. 168. Cloves are the unopened flower-buds of a tropical tree. These buds are picked and dried. The *oil of cloves* is sometimes extracted from the buds with water and is used as a medicine. Though cloves originally came from the East Indies, the *Island of Zanzibar* on the east coast of Africa is now the chief source of supply. Cloves are also grown to a less extent in the East and the West Indies (Fig. 76).

Sec. 169. Ginger is the dried underground stem of a reed-like tropical plant. This product comes from both the West and the East Indies, and also from Western Tropical Africa (Fig. 76). Besides being used as a spice, it is candied and used as a sweetmeat.

Sec. 170. Nutmeg and mace are products of the same plant. The surface of the *Banda Islands* in the East Indies is covered with nutmeg trees, which grow fifty to sixty feet high and bear fruit throughout the year (Fig. 76). The fruit is pear-shaped and about two inches in diameter. It splits into two halves and the husks fall off. The thick covering of the seed, which is removed and dried, is *mace*. The seed is dried for three months in ovens, and the shell is then removed from the kernel, which is the *nutmeg* of commerce.

Sec. 171. Allspice is the dried, unripened berry of an evergreen tree growing in the West Indies. The chief supplies come from Jamaica (Fig. 76).

Sec. 172. Vanilla is an extract from the long pods of a climbing tropical orchid, which grows most abundantly in Mexico and some Pacific tropical islands (Fig. 76). The beans, which are sometimes ten inches long, are allowed to ferment and are then soaked in alcohol. The alcohol dissolves the substances which are so pleasant to taste and smell. This solution is bottled and sold as *extract of vanilla*.

CHAPTER XV

TIMBERS

Sec. 173. Forests are widely distributed in the temperate and torrid zones. The lumbering industry of the temperate zone is much more developed than that of the torrid zone. Timber trees can be divided into two classes, the *coniferous* and the *broad-leaved* trees. Coniferous (*i.e.*, cone-bearing) trees are usually evergreens with long, narrow, needle-like leaves, bearing cones as fruit. Broad-leaved trees usually shed their leaves at the end of the summer in temperate zones and at the beginning of the dry season in tropical countries.

Sec. 174. The coniferous trees are by far the most important. Pines are the chief timber trees of the world, for their wood is well adapted to the chief structural purposes, being fairly soft, usually easy to work, and cheap. There are several species of pines, the fir, spruce, hemlock, and larch.

Sec. 175. The hard woods are broad-leaved deciduous trees, among which are the oak, elm, ash, maple, beech, birch, and hickory. There are other hard woods, not so well known in Canada, that are commercially important. *Teak* is a tree found in India and Burma. It is in many respects the most valuable of all woods, as it is straight-grained, does not warp or crack, and on account of its oily nature outlasts almost any other timber. *Mahogany* is found in Central America and the West Indies. It is a dark-coloured, very heavy, hard wood of a handsome appearance, and is used for making expensive furniture. *Ebony* is a name given to the wood of several trees. It is very hard, heavy, and black, takes an excellent polish, and is used in cabinet work for inlaying and for making handles. *Rosewood* is a very valuable cabinet wood that comes from Brazil and the West Indies. It is of a deep ruddy colour, richly streaked, and grained with black.

Sec. 176. Pitch, tar, resin, and turpentine.—The stumps and roots of the pine, larch, etc., are heated in ovens and the gases and liquids which are driven off are collected. Among the condensed products one of the chief is *tar*, which on further distilling leaves a residue of *pitch*.

From certain pine trees in Europe and in the Southern States a thick liquid exudes or is obtained by tapping the tree. This liquid is *turpentine*. When turpentine is heated strongly, a gas is driven off and condensed. This is the well-known liquid, *spirits of turpentine*. The residue left in the vessel is *resin* or *rosin*. The name turpentine is frequently given to spirits of turpentine.

PART III. REGIONAL GEOGRAPHY

CHAPTER XVI

NORTH AMERICA

Projects

Sec. 177. To study the coast of North America.—After studying Map 8 in the Atlas, answer the following questions: Which has the more irregular coast-line, North or South America? (Map 26.) North America or Europe? (Map 33.) What are the advantages of an irregular coast-line? Compare as to regularity the coast-line of the South-eastern States with that of the Eastern Canadian Provinces. Which of these coast-lines was probably formed by the depression of the land below the sea? (Sec. 128.) Which by the elevation of the sea-bottom above the water? What part of the west coast of North America was produced by depression? What mountains are close to the west coast of the United States? Why are there no large gulfs or bays along this part of the coast? Which has the more numerous harbours, the Pacific coast of Canada or of the United States? Why? What is the greatest depth of the water represented by light blue on the map? Is the shallow area wider on the east or on the west coast? At what point is it widest on the Atlantic coast? On the Pacific coast? Of what importance is this ledge? If Northern Canada and Alaska were elevated six hundred feet, what would become of the northern islands in the Arctic Ocean? What two continents would then be united? The land animals of Northern Canada are very similar to those of Northern Siberia; give a possible reason for this similarity. Would an elevation of six hundred feet have a similar effect on the West Indies as on the islands north of Canada? If the sea-bed to the east of Canada were elevated six hundred feet, where would the mouth of the St. Lawrence lie?

Sec. 178. To study the surface features of North America (from Map 8 in the Atlas).—What is the greatest elevation of that part of North America represented by dark green? By light green? By the different browns? Where is the most massive plateau situated? Where is this plateau widest? By means of the scale on the map find its greatest width, assuming all the

region more than five thousand feet high to be included in the plateau. How long is the plateau? What part of it is occupied by the Rocky Mountains? What parts of the plateau are more than ten thousand feet high? What two parallel ranges of mountains extend along the west side of the United States? What is the height of the region lying between these two ranges? Do any rivers cut right across from one side of the plateau to the other? Where in this plateau are the lowest lands found? Compare in size and height the plateau of Eastern North America with that of Western North America. What rivers cut through the Appalachian Plateau? What plain separates the Appalachian Plateau from the highlands of North-eastern Canada? Compared with the Appalachian Plateau and the Western Cordillera, is the surface of the highland north of the St. Lawrence basin rough or smooth? Is it high or low? Where are the lowest parts of the Great Central Plain? What is the greatest difference between the surface of the northern and of the southern part of the Great Central Plain? Describe the region between the Appalachian Plateau and the Atlantic Coast. Are there any great cities in North America situated on land more than one thousand feet high? Explain why most of the cities are on the plains.

Sec. 179. To study the climate of North America (from Maps 3, 4, 10, 11, and 12 in the Atlas).—Read Sec. 51 to understand the meaning of isotherm. In what general direction do the January isotherms run as they pass from the water to the land? What does this indicate as to the relative temperatures of the land and adjoining water during this month? How are the July isotherms bent in passing from land to water? Which isotherms cut the fortieth parallel of latitude in July? Which cut it in January? During the winter is the interior of the continent warmer or colder than the coastal regions? Which is warmer during the summer, the interior or the coast? Explain these differences in temperature (Sec. 49). What parts of North America are below the freezing-point in January? What part of North America is hottest during July? In moving during January from the north to the south of North America, through what range of temperature would you pass? Through what range in July? Why is the range greater in one month than in the other? During the winter which is warmer, the east or the west coast of North America? Explain. What are the January and July temperatures of Klondike, Winnipeg, St. Louis, New Orleans, and the City of Mexico respectively? How does the seasonal range of temperature, as inferred from the answer to the preceding question, change as you advance toward the Equator? Explain this change.

Political Divisions

Sec. 180.—To the north-east of the continent is *Greenland*, which is a colony of Denmark (Map 13 in Atlas). At the north-west is *Alaska*, which the United States bought from Russia in 1867. With these exceptions, the northern part of the continent is occupied by *Canada*, the largest country in North America. To the east lies the island of *Newfoundland*, which politically includes the adjoining coast of Labrador. Both of these countries are members of the British Empire. To the south of Canada lies the *United States of America*, forming a federal republic, the most populous and wealthy country on the continent. South of the United States is the *Republic of Mexico*, which gained its independence from Spain, after ten years of fighting, in 1824. To the south of Mexico are the three republics: the *Union of Central America*, *Nicaragua*, and *Panama*, as well as *British Honduras*. The *West Indies* are also geographically included in North America. Most of these islands belong to the British Empire, but one is independent, and several belong to France and the United States.

Physical Features

Sec. 181. Size and shape.—North America, the continent on which we live, is the third in size, being surpassed by Asia, which is more than twice as large, and by Africa, which is one and a half times as large. Fast trains take about five days to cross the continent from Halifax to Vancouver, and one man by the greatest exertion was able to walk across the United States in less than one hundred days.

The continent is widest towards the north, and narrows to a point at the south; it is thus shaped somewhat like a triangle.

Sec. 182. Coast features.—The northern part of North America is broken up into many large islands and peninsulas with comparatively shallow water between (Map 8 in Atlas), seldom more than six hundred feet in depth. In a milder climate such conditions would be of great advantage to a region, since all parts are so close to the sea that the surplus products could be cheaply exported and the foreign goods easily brought in. Moreover, a coast so irregular is bound to have many excellent harbours. But this region is so cold and the vegetation is so scanty that the natural physical advantages are of little value. The most important coast water of this region is *Hudson Bay*.

The eastern coast of Canada and of the New England and Middle States is also broken by many gulfs and bays and bordered by

islands. The *Gulf of St. Lawrence* extends far into the eastern part of Canada and is to a great extent separated from the Atlantic Ocean by the islands of *Newfoundland* and *Cape Breton*. Such irregular coasts as we have just described were undoubtedly formed by the depression of the land beneath the sea (Sec. 128).

The coast-line of the Southern States is of a totally different kind. It loses all ruggedness and becomes low and regular, the land sloping gradually back from the shore. The indentations are few and small. Off-shore sand-bars fringe the coast for hundreds of miles, protecting it from the force of the waves and currents. Between the shore and these bars, which are often raised above the surface, the water is shallow and marshy. Such a coast-line has very few good harbours and does not present the varied features of the more rugged coast of the north. The *Gulf of Mexico* extends far into the southern part of the continent, as Hudson Bay does into the northern part.

The western coast in some respects resembles the eastern. As far south as *Vancouver Island* the coast is a maze of islands, and long, narrow bays, called *fiords*. Being very deep, and bordered by high, rugged shores, these openings form excellent harbours, especially if the islands are situated near their mouths, as is frequently the case. The most important islands of this part of the coast are the *Queen Charlotte* group and *Vancouver Island*.

South of Vancouver Island the coast is in strong contrast to that farther north. It is high, rugged, iron-bound, with scarcely a break, except in California, where *San Francisco Bay* forms the only good ocean harbour on the western coast of the United States. The Pacific coast of Mexico and of Central America is equally rugged. The only break is the *Gulf of California*, a flooded valley between a range of mountains forming the peninsula of *Lower California* and a massive plateau in Mexico.

Sec. 183. Surface features.—The outstanding features of the surface of North America are a great western plateau, and a smaller and much older eastern plateau, with a great plain between, stretching from the Arctic Ocean to the Gulf of Mexico (Map 8 in the Atlas).

The western plateau is called the *Cordillera*. It is widest in the United States, where it extends more than one-third of the distance across the continent, and it becomes narrower toward the north, terminating in Alaska. On this high plateau there are many great ranges of mountains, the most massive of which run from north to south. The largest of these ranges, called the *Rocky Mountains*, extends along the eastern side of the plateau through the greater part of Canada and the United States. A second range, called the *Coast Mountains*, runs along the western coast of the United

[*Courtesy of Oregon-Washington Railroad.*

FIG. 80. CITY OF PORTLAND, OREGON, WITH MOUNT HOOD IN THE DISTANCE

What is the name of the river running through the city?

States, continuing north through Vancouver and Queen Charlotte Islands. The Coast Mountains are lower than the Rockies and are much broken. Just east of the Coast Mountains is a much more massive range, which contains some of the most magnificent peaks in the whole Cordillera (Fig. 80). It runs parallel with the Coast Mountains and has different names in different localities. In California it is called the *Sierra Nevada*, in Washington and Oregon the *Cascade Mountains*, while in British Columbia, where it skirts the Pacific, it is referred to as the *Coast Range*. To the east of the Sierra Nevada is a very high plateau, called the *Great Basin*.

The chief rivers draining this plateau are the *Yukon* in the north, and the *Fraser* and *Columbia* farther to the south. These two latter rise near the Rocky Mountains and cut their way through the plateau by magnificent gorges and canyons, and empty into the Pacific Ocean. In the south is the *Colorado River*, noted for its wonderful canyon a mile deep (Fig. 81). It empties into the Gulf of California.

Since this great plateau with its parallel ranges of mountains possesses few low passes, it has formed a formidable barrier to transportation between the east and the west. On the other hand, its mineral and forest wealth are unsurpassed.

The *Appalachian Plateau* on the east is much less massive. One reason for this is that it is much older, and is consequently so eroded that its present mountains are merely the more resistant roots of the higher ranges of an earlier age. This plateau is not so continuous as the Cordillera in the west. In broken masses it extends from the State of Alabama to the Maritime Provinces of Canada, and even appears in Newfoundland. Several of the rivers emptying into the Atlantic Ocean rise to the west of this plateau, and have cut down their channels through its mass. It hemmed in the early settlers along the bleak Atlantic coast, and it was through these river gaps that they finally ventured into the fertile plain to the west. The railroads between the east and west also occupy these river gaps.

Around Hudson Bay is a V-shaped highland, which is the oldest part of the North American continent. It is called the *Canadian Shield*. Though it was formerly very high, at present it has scarcely anywhere an altitude of more than two thousand feet, since it has been greatly worn down by erosion. Between it and the Appalachian Plateau is the fertile valley of the *St. Lawrence River*. This stream extends almost from the centre of the continent, and is by far the largest river of North America flowing into the Atlantic Ocean.

Between the highlands on the east and west of the continent

[*Courtesy of Santa Fe Railway.*

FIG. 81. GRAND CANYON OF THE COLORADO RIVER

Are the rocks in the side of the Canyon stratified or unstratified? From the vegetation would you infer the soil was fertile

lies the *Great Central Plain*, which extends from the Arctic Ocean to the Gulf of Mexico. This plain is low and flat in the north and south, and nowhere reaches much beyond two thousand feet in height. Close to the southern boundary of Canada is the divide that separates the basin of the *Mississippi River* from those of the *Saskatchewan* and *Mackenzie Rivers*. The Mississippi, with its tributary, the *Missouri*, is the longest river in the world and drains the most fertile part of the United States. The northern part of the Great Central Plain is drained by the Mackenzie River into the Arctic Ocean.

The whole northern part of the continent is dotted by many thousands of lakes of all sizes, from those covering only a few acres to the greatest bodies of fresh water in the world.

Climate

Sec. 184. Temperature.—Maps 10 and 11 in the Atlas show the isotherms for January and July. Of the entire continent only Central America and the southern part of Mexico are within the tropics. These regions have a temperature of over 60 degrees in winter, and over 80 degrees in summer. During the summer, however, the hottest part of the continent is a more northerly region including the plateau of Mexico and the south-western part of the United States. There are two reasons for the great heat of this region. The summer heat beats down almost vertically on this plateau day after day from a cloudless sky, and the high mountains on the west cut it off from the cooling breezes of the Pacific Ocean.

The greater part of Mexico, the whole of the United States, and almost all Canada lie in the temperate zone and have the typical climate of such a continental region (Secs. 140 and 150). It will be noticed from the maps that in the winter the isotherms are arched to the south, indicating that the coast is warmer than the interior. In the summer the isotherms are arched to the north, indicating that the temperature is higher in the interior than at the coasts. Both these conditions are due to the influence of the oceans, which warm adjacent lands in winter and cool them in summer. The further inland we travel the less is this oceanic influence felt. Moreover, the high ranges of the Cordillera, which run north and south, effectively cut off the interior from the moderating Pacific breezes. Indeed, with the exception of Central Asia, the extremes of temperature are greater here than anywhere else in the world.

The east side of the continent is warmer in summer and colder in winter than the west side. This is due to the fact that the

prevailing winds are from the west, and these tend to carry the extreme temperatures of the interior to the eastern side of the continent.

The temperatures of the temperate zone are those best suited to the highest development of man. This fact, together with the great mineral resources and fertile soil of North America, is bound in the future to make it the home of a dense population of industrious people.

In Northern Canada, Northern Alaska, and Greenland, the weather is extremely cold in winter, and during the short summer the very slanting sunlight is unable to raise the temperature much above the freezing-point.

Sec. 185. Precipitation.—In the tropical region the trade-winds blow steadily throughout the year (Maps 3 and 4 in Atlas). These warm, moist winds, striking the highlands of Mexico and Central America, produce heavy rains at all seasons of the year. But on the Pacific coast of this region the rain is much less abundant, especially during the winter, for the winds then blow from the land toward the sea. In the temperate region, during the winter, the prevailing westerlies blow the moist air against the mountains along the west coast and produce very heavy rainfall as far south as California. During the summer the winds blow almost parallel with the coast toward the Equator (Map 4 in Atlas). Such winds become warmer as they approach the Equator and consequently are drying winds. Hence, in the region to the south of Vancouver Island, the summer is a period of drought.

By the time the westerlies have crossed the Sierra Nevada in the south, the Cascades in Washington and Oregon, and the Rocky Mountains in British Columbia, the moisture has been taken from them, and beyond this they become drying winds. Accordingly, the Great Basin in the United States is a desert (Fig. 82), and those parts of Canada just east of the Rockies are very dry.

In the Great Central Plain the occasional warm winds which sweep north from the Gulf of Mexico and the South Atlantic Ocean bring rain. Their influence is mostly felt along the border of the Gulf of Mexico, where there is a rainfall of almost seventy-five inches. As these winds blow northward, the accompanying rainfall steadily diminishes, yet it is abundant on the Atlantic coast and moderate in Central Canada. During the winter much of the precipitation in the Northern United States and in Canada is in the form of snow. In the frigid zone the air is so cold that it contains little moisture at any time, and consequently there is little rain or snow.

[Courtesy of Professor D. T. MacDougal, Director of Carnegie Desert Laboratory, Tucson, Arizona.

FIG. 82. DESERT SCENE IN ARIZONA

Notice the tufts of sage-brush and the tall cactuses. Do any rocks project through the dry sand? Is the desert level or rolling? Notice the wide spaces between the individual plants.

Vegetation

Sec. 186. Distribution of vegetation.—The native vegetation of any place is determined largely by the amount of rainfall. Where this is abundant the land is well wooded, as in the tropical lowlands of Mexico and Central America, the eastern half of the continent, and on the Pacific slopes (Map 9 in Atlas).

In the western half of the Great Plains, as far north as Alberta

[*Courtesy of Geological Survey, Ottawa.*

FIG. 83. FLOWERS AND A MOTH FROM THE BORDER OF THE ARCTIC OCEAN

From a photograph taken by the Arctic expedition under Vilhjalmur Stefansson.

and Saskatchewan, where the rainfall is much diminished, the forests are replaced by *grass lands or prairies*. Further west in the interior of the Great Basin, where the annual rainfall is less than ten inches, the grass lands are replaced by a *desert steppe*, sprinkled with sage brush, a shrub from three to six feet high (Fig. 82). Here grass grows in scattered tufts. Only a small part of the Great Basin is absolute *desert* without vegetation.

As one travels north in Canada, the forest trees become more and more stunted on account of the short summers and the severe cold of winter. In the extreme north all trees disappear, leaving a

[*Courtesy of New York Zoological Society.*

FIG. 84. CARIBOU OR AMERICAN REINDEER

Found in very large droves in Northern Canada. An attempt is being made to establish caribou ranches for increasing the meat supply.

[*Courtesy of New York Zoological Society.*

FIG. 85. THE WALRUS

An inhabitant of the Arctic waters and ice packs. It lives on fish.

cold desert, where, however, vegetation is not entirely wanting; for in the marshes in summer the ground becomes covered with reindeer moss, on which the caribou and musk-oxen feed, and in some sheltered parts there are grass and flowers during the short summer (Fig. 83).

Sec. 187. The forests.—The forest region can be divided into the *tropical forest,* the *Atlantic forest,* the *Pacific forest,* and the *northern forest.*

The tropical forests are the most luxuriant in the world. More species of plants grow on one hundred square yards of such a forest than are found on one hundred square miles of a Northern Canadian forest. Palm-trees, tree-ferns, and many twiners give the tropical woods an aspect totally different from a forest in the temperate zone.

The Atlantic forest, which extends from the east coast to beyond the Mississippi River, is composed of broad-leaved trees, which shed their foliage every autumn. The maple, oak, elm, ash, and birch are characteristic of this region. This forest region has evergreens also, the white pine being characteristic of the north, and the yellow or Georgia pine of the south. Both of these pines are important timber trees, the white pine being the most valuable tree on the continent.

The Pacific coast, with its mild weather and abundant rainfall, produces the most magnificent forests found anywhere in the world. The Douglas fir is the most valuable timber tree of the coast. It reaches a height of two hundred and fifty feet. On the slopes of the Sierra Nevada grow the most gigantic trees found anywhere in the world, namely the redwood and the sequoia. The latter grows three hundred feet high and is sometimes twenty-five feet in diameter at the base.

The northern forest stretches across the central part of Canada from the Pacific to the Atlantic Ocean (Map 9 in Atlas, dark green colour). It has a monotonous appearance, for it contains only a few varieties of trees, the chief of which are the spruce, tamarack, poplar, and birch.

Animals

Sec. 188. The climate of North America ranges in temperature from the warmest tropical to the coldest Arctic; consequently, almost all classes of animals are represented. Yet it is pre-eminently a land of herbivorous, or herb-eating animals. The musk-ox and caribou or American reindeer are found in the extreme north.

[*Courtesy of New York Zoological Society.*

FIG. 86. MUSK-OXEN

These animals inhabit the extreme north of Canada; their flesh is good to eat. A company is attempting to establish ranches of these animals in the summer prairies of the north.

[*Courtesy of New York Zoological Society.*

FIG. 87. THE BISON OR AMERICAN BUFFALO

Formerly roamed in countless numbers over the Great Plains. Now only one flock left except those in captivity.

Farther south the bison or American buffalo once lived in great herds. It fed on the herbage of the grass land, and supplied a good deal of food to the Indians who lived on the prairies. But with the coming of white settlers, this monarch of the Great Plain rapidly disappeared. Several varieties of deer also, such as the moose, wapiti, and Virginia deer, were at one time widespread over the temperate zone. Over the same region are found many fur-bearing animals, such as the black bear, beaver, mink, skunk, otter, fisher, raccoon, marten, and rabbit. There are a few carnivorous animals, such as the polar bear of the Arctic regions, the fox, wolf, and lynx, which are widely distributed, and the jaguar, panther, and grizzly bear of the Rockies. All these, with the exception of the bears, feed on the smaller herbivorous animals. The polar bear feeds on seals and other aquatic animals, while the other bears are largely herbivorous.

Black flies are a scourge in the northern woods during the early summer, and mosquitoes are found throughout the continent except in the extreme north. These latter insects are the source of malaria and yellow fever, as well as a means of great discomfort.

People

Sec. 189. The Indians.—When America was discovered, almost all parts of it were occupied by Indians. There were many tribes of these native people, all living near rivers, lakes, or the ocean. Some were mere savages with very primitive tools and did not till the soil but lived by hunting and fishing. Others cultivated the land and lived in villages. Since the Indians were always at war among themselves, the population was probably never very large, and after the advent of the white man the tribes were still further reduced by war and disease and deprived of most of their land.

At present the American Indians live largely on *reserves*, that is to say, tracts of land assigned to them by the government. These reserves are scattered all over the continent. Most of the Indians have adopted a good many of the customs of the whites. Many cultivate the soil, others hunt, trap, and fish. In the less settled parts many of the Indians act as guides for the white man during his hunting, fishing, or exploring expeditions.

Sec. 190. The Eskimos. The Eskimos occupy the whole Arctic coast of North America, as well as the borders of Northern Hudson Bay and the Labrador Coast. No other people exist under such adverse circumstances. They depend chiefly on the seal, eating its

flesh, making clothes and houses of its skin, and burning its oil in lamps to keep them warm (Fig. 88).

Sec. 191. European immigrants. Since the discovery of North America, the few hundred thousand natives have been dispossessed of the greater part of the continent by Europeans. Spaniards settled in Central America and Mexico, British on the Atlantic coast, and French along the St. Lawrence River and the lower

Courtesy of Geological Survey, Ottawa.

FIG. 88. TWO ESKIMO WOMEN IN THEIR SUNDAY CLOTHES

Notice that their garments are made of skin. This is a summer costume. The photograph was taken on the coast of the Arctic Ocean by the Canadian Arctic expedition under Vilhjalmur Stefansson.

Mississippi. The British and their descendants, who were the most successful colonists, have spread over all the land except Quebec, Mexico, and the tropical parts of the continent and have become the predominant people. In order to obtain a supply of cheap labour adapted to the climate, many negroes were brought as slaves from Africa to the Southern States and the West Indies. They are now emancipated and form a large and increasing proportion of the population. The abundance of free or cheap land

and the great resources of Canada and the United States have attracted many millions of settlers from almost every country in Europe. As a result the population of the two countries has increased very rapidly until now it is about one hundred and thirty millions.

Questions

1. Alaska formerly belonged to Russia. How would you suppose that Russia gained possession of it?
2. State why the French living along the St. Lawrence River found their way to the Great Plain before the British who lived along the Atlantic Ocean (Map 8 in Atlas).
3. Give two reasons why the forests on the Pacific coast are more luxuriant than those on the Atlantic coast.
4. Why was the eastern side of the continent settled before the western side?
5. On which side of the continent would you expect to find the largest number of Chinese? Of Japanese? Of Italians? Give a reason in each case.

CHAPTER XVII

DOMINION OF CANADA

Projects

Sec. 192. To study the drainage of Canada. —Make a tracing of Fig. 80. Find the following rivers (see Map 18 in Atlas) and print their names on the map: Yukon, Skeena, Fraser, Columbia, Kootenay, Thompson, Liard, Athabaska, Bow, Saskatchewan, Nelson, Mackenzie, St. Lawrence. Draw a blue line round the land that drains into Hudson Bay. Draw a red line round the basin of the St. Lawrence and the Great Lakes. Draw a green line round the basin of the Mackenzie River. Draw a brown line round the land that drains into the Pacific Ocean. Into which body of water, the Pacific, Arctic, Atlantic, or Hudson Bay, is the largest part of Canada drained? Into which the smallest? Mark the course of the Canadian Pacific, and of the two transcontinental lines of the Canadian National Railways through the Rocky Mountains and over the rest of the Cordillera. What river does each railway follow through the Rocky Mountains? Explain the probable origin of the passes through which these railways pierce this range. What river does each railway follow across the plateau? Why were they built along the rivers? What rivers of the Great Central Plain rise west of the Rockies? What ocean or other large body of water finally receives the water from Lake of the Woods, Bow River, Kootenay River, Red River, and Lake Nipigon? About what fraction of the St. Lawrence Basin is in the United States? After studying Map 24 in the Atlas, mark the navigable parts of the rivers of Canada with a heavy blue line.

Sec. 193. To study the climate of Canada.—The answers to the following questions are to be obtained by a study of Maps 14, 15, and 16 in the Atlas, and Fig. 96 in this text-book. What part of Canada is warmest in July? Which is warmer in July, Montreal or Vancouver? Montreal or Halifax? Vancouver or Winnipeg? Dawson or Calgary? Give reasons in each case. Do the isotherms of British Columbia run more nearly parallel to the parallels of latitude or to the Pacific Ocean? Which, consequently, has the greater effect in determining the relative temperatures of the different parts of British Columbia, latitude or proximity to the Pacific Ocean? What January isotherms cut the fifieth parallel

FIG. 89. THE DRAINAGE OF CANADA

of latitude between the Atlantic and the Pacific Oceans? Where is it coldest along this parallel? Where is it warmest? Why is it warmest and coldest in these two regions? Why is it warmer toward the Atlantic Ocean than toward the interior? What part of Canada receives the heaviest annual precipitation? (Map 12 in Atlas.) What parts receive less than ten inches of precipitation? What part of Canada receives its greatest precipitation in the winter? (Map 3 in Atlas.) From an agricultural standpoint is this a good time to receive the greatest amount of rain? What part has its chief rain in the spring (Sec. 215)? From the same standpoint is this a good time in which to receive the greatest amount of rain? Explain why good crops are raised in parts of the Prairie Provinces though the annual rainfall is not more than fifteen inches? What parts of Canada receive the heaviest snowfall? (Fig. 96.) Why? What is the snowfall in the Prairie Provinces? Explain why it is much less than in Quebec, though the temperature is much lower during the winter in the Prairie Provinces (see Fig. 96 and Maps 3 and 4 in Atlas).

Extent and Boundaries

Sec. 194. Extent.—The Dominion of Canada is surpassed in area only by two countries, Siberia and China. Canada is larger than the continent of Australia and almost as large as the continent of Europe. It forms almost one-third of the British Empire. The area is more than three and one-half million square miles. Much of this territory, however, lies too far to the north to be suitable for settlement.

Sec. 195. Boundaries.—Canada has had several disputes with the United States as to the position of the boundary line between the two countries. But all these disputes have been definitely settled. The northern boundary of Canada is still a little uncertain owing to the new islands which are being from time to time discovered by explorers and annexed to Canada. All we can say, then, is that the Arctic Ocean, Baffin Bay, and Davis Strait form the northern boundary (Map 17 in Atlas). On the west, Canada is bounded by Alaska and the Pacific Ocean. The latter forms only the southernmost third of the boundary owing to the presence of a long strip of coast belonging to Alaska, which cuts off the adjoining third from the sea. Canada is bounded on the south by the United States. On the east it is bounded by the Atlantic Ocean and by a narrow strip of territory belonging to Newfoundland and extending along the Atlantic coast of the Labrador Peninsula. But the exact position of the boundary between Canada and Labrador has not been definitely settled and is at the present time in dispute.

Political Divisions

Sec. 196.—The Dominion of Canada is divided into nine provinces, one territory, and three districts (Map 17 in Atlas). The provinces from east to west are as follow: *Nova Scotia*, *New Brunswick*, and *Prince Edward Island*, which are often called the *Maritime Provinces*, since they have long sea-coasts; *Quebec* and *Ontario*, the two oldest provinces of Canada, which were formerly confined to the St. Lawrence basin, but as a result of recent acquisitions of new territory now extend far to the north into the Canadian Shield; *Manitoba*, *Saskatchewan*, and *Alberta*, which spread across the Great Central Plain and the Canadian Shield from the Rocky Mountains to Hudson Bay and are often called the Prairie Provinces, though only the southern part is grass-land: and *British Columbia*, which extends over the Cordillera to the Pacific Coast. The *Yukon* territory lies to the north of British Columbia. Immediately north of the Prairie Provinces are the districts of *Mackenzie*, *Keewatin*, and *Franklin*. Keewatin includes the islands of Hudson Bay, and Franklin those of the Arctic Ocean. The extent of these districts is shown in Map 17 in the Atlas.

Coast Waters

Sec. 197.—Three sides of Canada border on the ocean, and a great inland sea, *Hudson Bay*, extends almost to the centre of the continent. Every province of Canada except Alberta and Saskatchewan borders on salt water. As we saw in Sec. 182, the coast-line on the east, west, and north is very irregular, abounding in gulfs, bays, and islands. The Atlantic coast-line is five thousand miles and the Pacific coast-line is over seven thousand miles long. Almost every bay and fiord offers safe anchorage, so that there are numerous natural harbours.

Sec. 198. Hudson Bay.—By far the largest of the coast waters is Hudson Bay, a great sea situated in the central part of Canada and connected with the Atlantic Ocean by *Hudson Strait*. This bay is more than eighteen times as large as Lake Superior, and almost three times as large as France or Germany. Its southern projection, *James Bay*, extends far down into the continent between Ontario and Quebec. The depth of the main bay is four hundred feet, but James Bay is so shallow that the bottom can often be touched with an oar from a boat when the occupant is out of sight of land.

The water in Hudson Bay is salty, but in James Bay it is only brackish. This latter condition is due to the large volume of fresh

water poured into James Bay from the numerous streams draining the slopes of the Canadian Shield. The tides rise as high as thirty feet in Hudson Strait and are also decidedly marked in the Bay, the water in the estuary of the Nelson River rising by more than fourteen feet.

The waters of Hudson Bay are apparently not well supplied

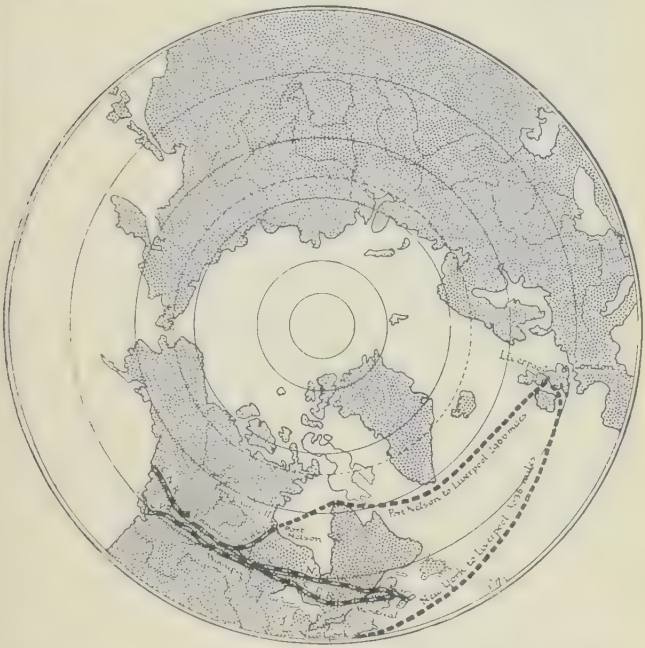


FIG. 90. MAP TO SHOW WHY THE DISTANCE FROM PORT NELSON TO LIVERPOOL IS LESS THAN FROM NEW YORK TO LIVERPOOL

with fish, but its whale fisheries have been valuable for several centuries. The rivers emptying into the Bay are well stocked with salmon and other food fishes. Along its coast are many ducks, geese, ptarmigan, caribou (Fig. 84), and other game.

The coast-line of Hudson Bay is regular. Along the whole southern part the land slopes up from the water in a gently rising plain. Toward the north the elevation is higher, and the coast of Hudson Strait is so high that, although the strait is one hundred

miles wide, for the greater part of its length both shores are readily visible from ships passing through.

Sec. 199. Is Hudson Bay navigable?—It would be of great advantage to the people of Western Canada if their exports could be shipped out by way of Hudson Bay. The distance from Winnipeg to Liverpool *via Port Nelson*, the chief port, is five hundred miles less than *via* Montreal, and from Edmonton to Liverpool almost one thousand miles less. And, surprising as it may seem, Port Nelson is nearer to Liverpool than is New York, yet Port Nelson is almost at the centre of the continent. The reason for this is best understood if one examines the distances on a globe. Port Nelson and *Fort Churchill* are so far north that the distance around the earth in their latitude is much less than in the latitude of New York or Montreal (Fig. 90). Therefore, though farther west than New York and Montreal, these Hudson Bay

[Courtesy of Hudson Bay Company.

FIG. 91. HUDSON BAY COMPANY POST AT LAKE HARBOUR BAFFIN LAND

Find Baffin Land on the map. Will the inscription on the sign-board to the right be Indian or Eskimo? What is the nature of the land surface? Why are there no trees? To this store the natives bring their furs and receive in exchange groceries, clothing, tobacco, and everything else they require.

ports are less distant from Liverpool. Accordingly, if the difficulties of navigation on the route were overcome, much of the grain of both Western Canada and the United States would be shipped by the northern route in order to avoid the long and expensive haul on the railways and the longer sea voyage. Canada has so much confidence in the route that its government has already a railway to Port Nelson well under way.

The ice in Hudson Strait forms the chief impediment to navi-

gation. This ice, which comes from the Arctic Ocean, is driven by the north-west winds into the Strait during the spring, and the strong tidal currents sweep it back and forth. Another danger to navigation is the stream of ice one hundred miles wide, brought down by the Arctic current through Davis Strait and past the eastern entrance of Hudson Strait. As a result of these

[*Courtesy of F. C. C. Lynch, Superintendent, National Resources, Intelligence Branch, Department of the Interior, Ottawa.*

FIG. 92. TRANSPORT ON THE ATHABASKA RIVER, NEAR FORT McMURRAY

How wide does the river appear to be? Is the district covered with grass or trees? People travel hundreds of miles in such boats and may be weeks or months on a trip.

hindrances navigation at the best will not open until 1st July, and will close early in November. During the intervening four months, if suitable ships were provided, much grain could be carried to Europe, and the Hudson Bay route may yet prove to be a great highway of commerce. The Hudson Bay Company for over two hundred years has successfully used this route to bring in supplies and to take out furs (Figs. 91 and 92).

Surface Features

Sec. 200. Divisions.—The general character of the surface of Canada has been already described in Sec. 183. According to its nature the country can be divided into the following regions (Fig. 93): (1) *The Cordillera,* which extends from the Rocky Mountains to the Pacific Coast. (2) *The Canadian Shield,* which

FIG. 93. NATURAL PHYSICAL DIVISIONS OF CANADA

Which of these divisions extend into the United States? At what two points does the Canadian Shield enter the United States? Which of these divisions contains the greatest population?

extends around Hudson Bay. (3) *The Appalachian Region*, which comprises the Maritime Provinces and the rougher parts of the Province of Quebec south of the St. Lawrence River. (4) *The Great Plain*, which lies between the Cordilleran Region and the

FIG. 94. PARTS OF CANADA COVERED BY ICE SHEETS

The arrows indicate the directions in which the ice sheets flowed. Note the small patch in Gaspé, part of the Cordilleran, and North-western Canada and Northern Alaska, which were never covered by ice sheets.

Canadian Shield. (5) *The St. Lawrence Lowlands*, which lie between the Canadian Shield and the Appalachian Region.

Sec. 201. The glacial period.—In order to understand the surface character of all these regions, it is necessary to describe a remarkable event that affected the greater part of Canada many thousands of years ago. The climate gradually became cooler, and snow and

ice began to accumulate at three centres in Canada. One was near the middle of Labrador Peninsula, another west of Hudson Bay, and a third along the Cordillera (Fig. 94). As the ice and snow grew thousands of feet in thickness, the great mass was pressed out at the edges, just as a pile of pitch, when left on the ground, spreads out in every direction. The edges of the ice moved forward as indicated by the arrows in Fig. 94. It will be seen from the figure that the ice-caps spread until they covered almost all of Canada and a considerable part of the Northern United States.

As this mass of ice, thousands of feet in thickness, slowly moved forward, it exerted great pressure on the rocks and soil beneath it. Rocks were broken to pieces, the tops of jagged hills were worn off and rounded, and much rock was ground into soil. As they moved along, the hard rocks frozen in the bottom of the ice, polished, scratched, or furrowed the underlying rocks. The layer of soil on the surface, especially near the centres, was pushed toward the margins, and great masses of rock were transported with it.

When the ice melted, the surface of the region was greatly different from what it was before. Most of the soil had been entirely scraped from the surface of the Canadian Shield and had been unevenly deposited in the southern parts of Eastern Canada and in the Great Central Plain which thus assumed a rolling character. The deposits of soil were left mixed with rounded stones or boulders, which the ice had torn from the rock and transported many miles. Where the boulders were numerous, the soil is to-day very stony.

The deposits of this *boulder clay*, as it is called, left by the glacier, had a marked effect upon the drainage. Many river valleys were so choked up that the water was dammed back to form lakes. The water would overflow at the lowest lip and tumble over uneven surfaces through a series of rapids and waterfalls until it again accumulated in another lower hollow to form a new lake. Hollows that were scooped out of the softer rocks by the ice also became lakes. The accumulation of soil and boulders at the lower end of a tongue of ice extending into a valley made a dam across the lower end when the ice melted, and a lake was left above the stony dam.

Consequently, at the close of the period, the northern part of the surface of North America was left profoundly different from the southern part. The rivers to a great extent occupied new valleys and had many lake expansions. Their courses were very irregular with many rapids and waterfalls. The whole country was dotted with lakes of all sizes, so that to-day the lakes of Canada are so numerous that half the fresh water of the whole earth is

contained in them. The rocks are left bare of earth in some places and in others there is a deep accumulation of glacial deposits. These deposits at some places are fine and make fertile soil, at others they are gravelly or stony, making cultivation difficult.

Sec. 202. The Cordilleran Region, the southern part of the Great Plain, the Appalachian Region, and the St. Lawrence Lowlands will be described fully under the provinces to which they mostly belong. Here we shall describe the Canadian Shield and the northern part of the Great Plain.

The Canadian Shield

Sec. 203. Extent.—Considerably more than half of Canada is occupied by the Canadian Shield, which stretches in a great horseshoe around Hudson Bay (Fig. 93). All the Labrador Peninsula is occupied by it. It skirts the north shore of the St. Lawrence River almost to the city of Quebec, occupies the whole northern part of Ontario right down to the north shores of Lakes Superior and Huron, and borders the east side of Georgian Bay. A tongue of it extends down through Eastern Ontario to the head of the St. Lawrence River, which it crosses at the Thousand Islands and enters the State of New York. Its western boundary is formed by the chain of lakes which includes the Lake of the Woods, Winnipeg, Athabaska, Great Slave, and Great Bear Lakes.

Sec. 204. Surface composition.—Hundreds of thousands of square miles of the surface of the Canadian Shield is formed of a hard rock, called *gneiss*. This is a reddish rock with bands of black mica running along it. In other parts there are granites, limestones (Fig. 54), marbles, slates, and many other rocks. Over very large areas the bare rock is exposed, but there is usually enough soil in the crevices and on the surface to support a dense forest. Just south of James Bay is a great stretch called the *Clay Belt* (Fig. 93). This is really the bed of an old lake called *Ojibway*, and the clay has been formed from the sediment, which forms very fertile soil. Other stretches of good farm land are widely distributed over the surface of the Canadian Shield.

Sec. 205. Drainage.—The Canadian Shield is generally level. It slopes back very gradually from James Bay and the southern part of Hudson Bay and gradually rises toward the Great Lakes. The *height of land* or divide is much nearer to the Great Lakes than to Hudson Bay. The slope south of the divide is steeper than that toward the north. Consequently, the rivers flowing south into the Great Lakes have many more rapids and falls than those flowing into Hudson Bay and James Bay.

Sec. 206. Altitude.—The Canadian Shield is not high. Map 18 in the Atlas shows that nowhere except in the extreme north-western part of Labrador is it much more than two thousand feet above sea-level, and a very large part of it surrounding Hudson Bay has an altitude of less than one thousand feet. Although it is often rough and rugged, it is nowhere mountainous. In fact, it is comparatively flat. If one stands in an elevated position, the whole country around can be seen for many miles.

Sec. 207. Rivers.—Many large rivers drain the Canadian Shield toward Hudson Bay. At the mouth of almost every important river is a trading post of the Hudson Bay Company (Fig. 91). Throughout the interior of the region the Indians trap and shoot the numerous fur-bearing animals. They paddle down the rivers to the trading posts with their season's catch of furs, and exchange them for clothes, sugar, flour, ammunition and other commodities.

The rivers flowing into the Great Lakes are much smaller and have many rapids.

Sec. 208. Minerals of the Canadian Shield.—The Canadian Shield has the oldest surface rocks to be found anywhere in the world. Mountains, some of which were miles in height, that formerly rested above these rocks, have been completely eroded by water and other agents. When the rocks now exposed were deeply embedded, they were subjected to great strain, heat, and pressure. It is under such conditions that mineral veins are formed, and we should therefore expect the Canadian Shield to be one of the very greatest mineral areas in the world. Although only its southern fringe has been explored, it is already yielding many millions of dollars' worth of minerals. Including the part in the United States, it has supplied the world with the greatest iron, copper, and nickel mines in existence, and large deposits of silver and gold are being worked. Moreover, many non-metallic minerals and rocks, such as graphite, corundum, granite, arsenic, talc, and feldspar, are already mined. When the whole area of over two million square miles is explored it will probably surpass all other mining regions in its output.

The Mackenzie Basin

Sec. 209.—The northern part of the Great Plain is the drainage basin of the Mackenzie River. This region is much more hilly than that part of the Great Plain farther south. The banks of the river are wooded right to the shore of the Arctic Ocean. Wheat and cattle can be raised as far north as Great Slave Lake. Vegetables such as potatoes, peas, turnips, beets, cabbages, and onions, and

[Courtesy of T. C. C. Lynch, Superintendent, Natural Resources, Intelligence Branch, Department of Interior, Ottawa.

FIG. 93 VEGETABLES GROWN AT FORT VERMILION IN NORTHERN ALBERTA, NEARLY 350 MILES NORTH OF EDMONTON

Name all the vegetables which you can see in the picture. Which common ones that grow in your district are missing?

fruits such as strawberries, currants, and gooseberries can be grown just as well in the neighbourhood of Great Slave Lake as one thousand miles farther south (Fig. 95). Recently a promising oil-field around Fort Norman has been discovered (Fig. 97).

Drainage

Sec. 210.—The great rivers of Canada are much more irregular in their courses than those of the southern part of the continent. This is due, as was explained in Sec. 201, to the effects of glacial action. At the close of the glacial period the old river basins were blocked, so that the rivers were compelled to find new courses in apparently the most haphazard way. They have many lake expansions, some of great size, and their courses contain many rapids and waterfalls. These conditions have proved to be of great benefit to Canada. The large lakes form important means of boat transportation, and produce copious supplies of food-fish. The rapids and waterfalls, which a few years ago were judged to be only a hindrance to navigation, are now recognised as one of Canada's greatest resources, since they are being increasingly used for the generation of electrical power. Already almost all the machinery in the factories and other manufacturing establishments is being run by this means. This power is also the chief source of artificial lighting, is increasingly used for cooking, and may in time partially replace coal and wood for heating.

The four great river systems of Canada are the *St. Lawrence* in the east, the *Mackenzie* in the north, the *Fraser* in the west, and the *Nelson-Saskatchewan* in the centre (Fig. 80).

Sec. 211. The St. Lawrence River.—Canada's most important river is the St. Lawrence with its magnificent expansions, the *Great Lakes*. This stream is ninety miles across at the mouth, and one hundred and fifty miles up it is still over twenty miles wide. It offers a waterway two thousand miles long, reaching from the ocean to the very heart of the continent.

The largest ocean steamers can ascend the St. Lawrence as far as Montreal. Above this point there are several rapids, to avoid which, canals have been cut, which permit boats 255 feet long and drawing 14 feet of water to pass through to a point more than two thousand miles from the Atlantic. But the St. Lawrence River freezes over during the winter, and consequently navigation is open for only a little more than seven months in the year. Yet the traffic of the Great Lakes and the St. Lawrence is far greater than that of any other highway of commerce in the world. Grain, iron ore, copper, lumber, and other raw products are shipped along this route from the interior to the eastern provinces and

states and thence in many cases to Europe. Coal and manufactured articles are shipped back for distribution through the western regions.

The Great Lakes are more fully described in Secs. 284–288, and the St. Lawrence River in Secs. 267–272.

Sec. 212. The Saskatchewan-Nelson River system.—The Nelson is the most important river emptying into Hudson Bay. It is a muddy, turbulent stream, in some places more than a mile and a half wide, but owing to its rapids, unsuitable for navigation. The great volume of its waters is due to the fact that it drains *Lake Winnipeg* into which flow the *Red*, *Winnipeg*, and *Saskatchewan* Rivers. The last-named is a great stream over twelve hundred miles long, which rises in the Rocky Mountains and follows a very tortuous course through the Prairie Provinces. This river is navigable for shallow draught steamers for over eight hundred miles. The Red River which rises south of the Canadian border, also empties into Lake Winnipeg. Consequently the Nelson River receives the drainage water from a very large part of the land lying between Lake Superior and the Rocky Mountains.

Sec. 213. The Mackenzie River.—The Mackenzie River with its tributary the *Peace* is slightly longer than the St. Lawrence with the Great Lakes. The Mackenzie drains a series of lakes, the largest of which are *Great Bear Lake*, *Great Slave Lake*, and *Lake Athabaska*. The Mackenzie is a giant stream with an average width of more than a mile. It is navigable for more than twelve hundred miles from its mouth, and further up has another stretch of over six hundred miles of navigable water. But as it freezes over during the winter, it is navigable only for four or five months of the year. Both the river and its connecting lakes are well stocked with white fish and very large trout.

Climate

Sec. 214. Climate of Cordilleran region.—On the lower and more southern parts of the Pacific Coast the warm winds from the ocean make the climate very mild during the winter, and in summer the cooling breezes from the same quarter prevent such excessive heat as that experienced in Eastern Canada. The rainfall is heavy, the western coast of Vancouver Island having over one hundred inches (Maps 14, 15, and 16 in the Atlas).

A short distance inland the rainfall diminishes to less than half this amount. The winters are cooler than on the coast, but still spring open, early, and there is seldom frost as late as May. The rainfall in this region is about twice as heavy as in Quebec and Ontario, but more than two-thirds of it falls during the winter.

On the interior plateau of British Columbia to the east of the Coast Range the climate is much drier, as the Pacific breezes have lost much of their moisture. Map 16 in the Atlas shows that many parts are even arid, having less than ten inches of rainfall per annum. The summers are warmer, and the winters colder than on the mainland near the coast. But the winter cold is never severe, and in the lower parts March is a spring month. In the southern valleys peaches and tobacco are successfully grown.

Sec. 215. Climate of the Great Plain.—Just east of the Rockies the winter climate is the most variable in the world. As a general rule this season is very cold from November to March, but in some years warm days with bright sunshine are frequent throughout the winter. The mild winter weather is due to the warm, dry wind, called *chinook*, which blows down from the mountains. April in Alberta is a true spring month.

In the spring occur the heaviest rains, just when they are needed. The rainfall during May and June is almost as heavy as in Quebec and Ontario for the same months. During July and August the weather is bright and hot in all parts of the province, for the summer isotherms in Alberta (Map 15 in the Atlas) run almost north and south, which indicates that the temperatures are about the same in the north as in the south.

In Saskatchewan and Manitoba the climate is more extreme than in Alberta. The winters are the coldest anywhere in Southern Canada. The summers are warm. Whereas the difference in temperature between the warmest and the coldest month in Victoria, B.C., is twenty-one degrees, in Winnipeg it is seventy-one degrees. The change from winter to summer is very sudden. The beginning of April may be very wintery, and the latter half may be almost as warm as summer. May is usually a spring month, though there may be occasional frosts or even snow. More than half the rain falls between May and August, and these heavy rains, combined with the great warmth, make the growing season a prolific one. Both rainfall and snowfall increase from west to east (Map 16 in the Atlas and Fig. 96). The ground is covered with snow throughout the winter, but it is not so deep as in Quebec (Fig. 96). Late frosts in spring and early frosts in August are a constant danger to the crops. In most winters there are occasional heavy northwest gales accompanied by blinding drifts of dry snow. These storms are called *blizzards*.

Sec. 216. The climate of Ontario and Quebec. The southern peninsula of Ontario is almost surrounded by the Great Lakes, and these tend to diminish the severity of the winter and the heat of the summer. Although in this peninsula snows may occur in

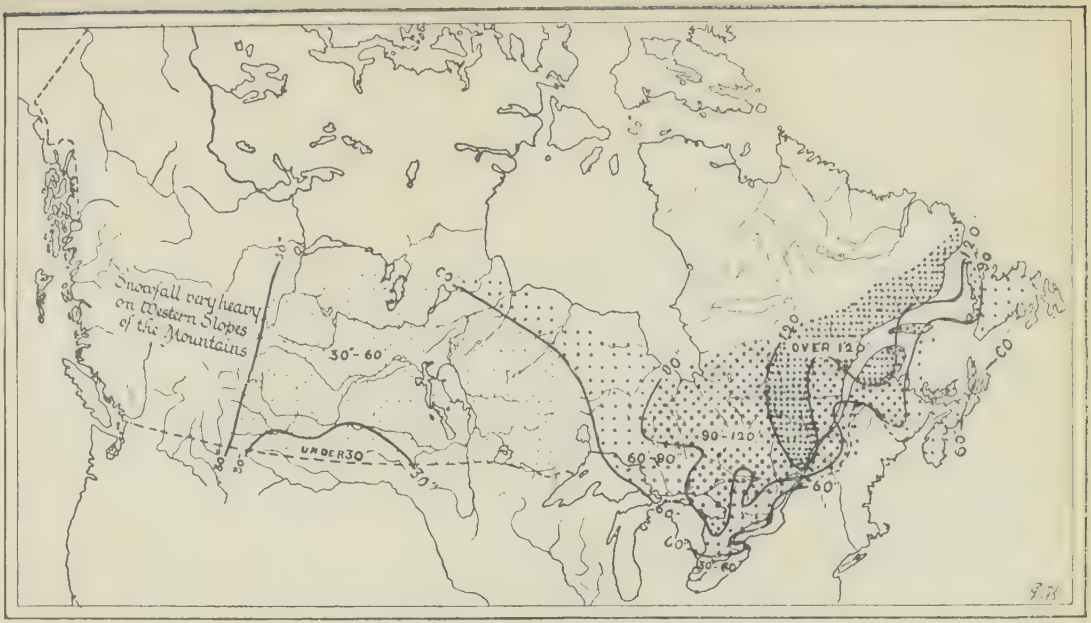


FIG. 96. SNOWFALL MAP OF CANADA

Sec. 220. Timber resources.—Although much timber has been cut in the Eastern Provinces, and much has been destroyed by fires, Canada still has the greatest supply of timber of any country in the world. There are great quantities of wood in the southern part of the Canadian Shield in a strip four hundred miles wide, stretching across Ontario and Quebec. Just north of this is a forest strip, equally wide, covered with smaller growth suitable for pulp-wood and extending from Labrador to Yukon and the Arctic Ocean. It is in British Columbia that the greatest undeveloped timber resources are to be found. Practically the whole province is covered by forest. Some of the trees in these forests are of immense size and of great value.

Sec. 221. Fishery resources.—The fisheries on both the Atlantic and Pacific coasts are well developed, as are those of the Great Lakes; and the fishing grounds off both coasts are the greatest and most productive in the world with the possible exception of those north-west of Europe. But the thousands of lakes and rivers of Northern Canada have scarcely been touched; and it is well known that all these northern waters teem with the choicest food fishes.

Sec. 222. Power resources.—Electrical power generated by waterfalls and rapids is speedily replacing steam power for running machinery. Canada has almost the greatest water-power of any country in the world. Every river in the vast Canadian Shield has its rapids and waterfalls, and in the Cordillera the streams flowing from their beginnings in the Rockies to the sea descend in many falls. Most of these can be harnessed by man and be made to do his work. Already a beginning has been made with wonderful results.

Industries

Sec. 223. Agriculture.—The most important industry in Canada is agriculture, almost half of the people being engaged in some branch of farming. In the Maritime Provinces potatoes are a very important crop, and the apples of Nova Scotia are famous. In Quebec and Ontario mixed farming is common. Oats, barley, and potatoes are grown; swine, cattle, and horses are kept on almost every farm; and large quantities of butter and cheese are made. The farmers of the Prairie Provinces are for the most part grain-growers. Their wheat is the best in the world, and this region has already become one of the greatest wheat centres. They also raise large quantities of oats, barley, and flax (Fig. 98). Agriculture is yet in its infancy in British Columbia. The favourable climate makes it possible to raise more wheat, oats, peas, and potatoes to

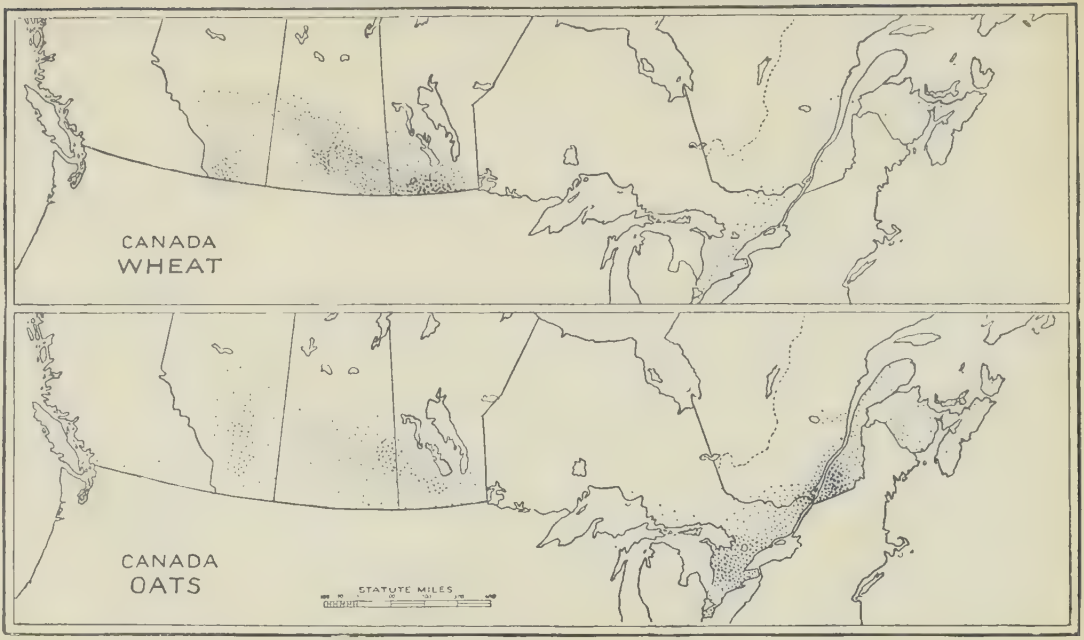


FIG. 98. CANADA'S PRODUCTION OF WHEAT AND OATS

Name in order of acreage the four chief wheat-growing provinces; the five chief oat-growing provinces. Which has the more northern range in Canada, wheat or oats?

the acre than in any other province, but little land is yet under cultivation. British Columbia is also becoming a great producer of fruits such as apples, grapes, and peaches.

Sec. 224. Fishing.—Along the coast of the Atlantic Ocean and the Gulf of St. Lawrence the chief industry is fishing. Cod, haddock, herring, lobster, mackerel, and many other fish are caught and shipped fresh, dried, or salted to the rest of Canada, the United States, the West Indies, and Europe. The lobster and cod are by far the most valuable fish on the Atlantic coast. British Columbia is the greatest fishing province in Canada. Its most important fish is the salmon, and next in importance is the halibut, which is shipped frozen in large quantities to Quebec and Ontario. In Ontario large quantities of whitefish, herring, and salmon trout are obtained from the Great Lakes.

Sec. 225. Lumbering.—Canada has still the greatest lumbering resources in the world. In Ontario, Quebec, and New Brunswick lumbering is an important industry. Pine, cedar, and hemlock are the chief soft woods; elm, ash, oak, maple, and birch the chief hard woods. The smaller trees, especially spruce, are now used extensively for making pulp. In British Columbia there are great forests, but the lumber trade has suffered in the past through lack of a market. Now, however, the lumber of British Columbia is being shipped extensively not only to the Prairie Provinces, to Ontario, and Quebec, but to Europe, Australia, and South Africa.

Sec. 226. Mining.—Mining is carried on in every province, but more than half of the minerals produced come from Ontario. British Columbia stands next to Ontario as a mining province, and Alberta third (Fig. 99). Our most valuable mineral is coal, of which Alberta and Nova Scotia each produces about two-fifths, and British Columbia most of the remainder. Nickel, the next most valuable mineral, comes entirely from Ontario. Copper, which comes third in value, is produced in British Columbia, Ontario, Manitoba, and Quebec. Silver and gold come chiefly from Ontario, British Columbia, and Yukon, but Ontario mines more than half of the gold and more than four fifths of the silver. Lead and zinc are mined in British Columbia, about ninety per cent. of the world's supply of asbestos comes from Quebec, petroleum is obtained in Western Ontario and along the Mackenzie River, and natural gas and salt come from Western Ontario. Ontario and Quebec produce over four million dollars' worth of cement per annum.

Sec. 227. Manufacturing. Canada has made rapid strides in the development of her manufactures. Although before the Great War her manufactured goods were largely used by herself, and even for the home market she supplied a smaller amount of goods

FIG. 99. MINERALS OF CANADA

than either Great Britain or the United States, now not only does she supply a much larger proportion of the home market, but she has become an important exporter of manufactured goods.

Her manufactures are chiefly those made from her own raw materials, such as flour, lumber, pulp, wooden implements, furniture, butter, and cheese. However, she has made a beginning in other commodities, and much sugar, woollen goods, cotton goods, boots and shoes, steel rails, agricultural implements, and other coarse manufactures are now being produced for the home market as well as for export.

With the great development of water-power this industry should rapidly increase, and she should in the near future become a large exporter of manufactured articles.

Trade

Sec. 228. Exports.—Canada's exports are chiefly raw materials, the products of her farms, forests, mines, and seas. The exports are divided about evenly between Great Britain and the United States. Canada also exports considerable quantities of goods to Newfoundland, the West Indies, France, Belgium, Australia, and South Africa. The chief export is agricultural produce. Wheat, by far the largest export, is shipped most largely to Great Britain; lumber is next, two-thirds of which goes to the United States, the remainder largely to Great Britain. Cheese, which comes third, is exported entirely to Great Britain; then comes flour, which also goes chiefly to Great Britain; and silver, equally distributed between Great Britain and the United States. The latter country also takes most of Canada's export of gold, copper, nickel, coal, and asbestos, as well as a great deal of flax-seed. The other important products of the farm are bacon, which goes to England, and hides, which go to the United States. Salmon and lobsters are exported in large quantities to Great Britain, and the United States takes much fresh fish of all kinds. The furs from the north are exported in large quantities to the same two countries. Most of the wood pulp and paper are exported to the United States.

Sec. 229. Imports.—By far the largest part of Canada's imports comes from the United States, the rest in quantities diminishing in this order from Great Britain, the West Indies, France, India, Switzerland, New Zealand, and Argentina. The chief raw products imported are coal, rice, tobacco, hides, and cotton from the United States, and wool from New Zealand and Argentina. The principal imports, however, are manufactured articles, such as metal goods, cotton, woollen, and silk fabrics. These come largely from the United States, Great Britain, France, and Switzerland.

[*Courtesy of the Canadian National Railways.*

FIG. 100. ONE OF CANADA'S MERCHANT SHIPS

One of the sixty-six large ocean steamers either completed or under construction for the Canadian Government National Railways under the name Canadian Government Marine.

Transportation

Sec. 230. Water transportation.—Canada with her long coast-lines both east and west stands high as a shipping country. She has regular lines of steamers running to Great Britain, South America, and the West Indies on the east, and to Japan, China, Australia, India, and New Zealand on the west. As the Canadian Government has completed or under construction over sixty ocean-going steamers (Fig. 100), which, under the name of the Canadian Government Merchant Marine, she is running in connection with the Canadian National Railways, a great development in trade with the West Indies, South America, India and the East may be expected. As trading treaties with the greater number of the British West Indies have recently been signed, an especially rapid development in trade with these islands may be expected.

She has also a large coasting trade with the United States on both the Atlantic and the Pacific Oceans. The chief ports on the east are *Montreal*, *Quebec*, *St. John*, and *Halifax*, but the two latter are the only winter ports. The chief ports on the Pacific coast are *Vancouver*, *Victoria*, and *Prince Rupert*.

The inland waters of Canada are unsurpassed in extent and usefulness. As we have seen, the St. Lawrence and Great Lakes allow large vessels to penetrate to the centre of the continent. Every province has its streams and boundary waters navigated by steamers. Waterfalls and rapids have been overcome by cutting canals. These streams with their canals will be dealt with more fully in the descriptions of the separate provinces.

Sec. 231. Railways (Map 17 in Atlas).—Canada has more miles of railway in proportion to her population than any other country in the world. She already has more than thirty-five thousand miles of line completed. There are three transcontinental railways, the Canadian Pacific and two lines of the Canadian National Railways.

The Canadian Pacific Railway, which has a mileage of thirteen thousand, runs from Vancouver in British Columbia, along part of the Fraser River valley through the Cordillera, and crosses the Rocky Mountains by the *Kicking Horse Pass* at a height of over five thousand feet. It passes through *Calgary*, *Regina*, *Winnipeg*, *Fort William*, *Sudbury*, *Ottawa*, *Montreal*, *Sherbrooke*, cuts across the State of Maine, and reaches the sea at *St. John*. The Canadian Pacific also runs trains over a line of the Canadian National Railways from St. John to Halifax. It has fleets of magnificent steamers on the Atlantic and Pacific Oceans as well as on the Great Lakes.

FIG. 101. QUEBEC BRIDGE [*Courtesy of Canadian National Railways.*

The central span, the longest in the world, is 1800 feet long. It is high enough to let vessels with the tallest mast pass under. What river does it cross? What city is to be seen in the distance? What kind of banks has the river at this point? What railway crosses on the bridge?

The Canadian National Railways system, which is owned and operated by the Dominion Government, now controls what was formerly the Canadian Northern, Grand Trunk Pacific, Grand Trunk, National Transcontinental, Intercolonial, and Hudson Bay Railways. With its twenty thousand miles of track it is the greatest railway system in the world. One of its transcontinental lines begins like the Canadian Pacific at Vancouver, but runs much farther north, and crosses the Rocky Mountains by the *Yellowhead Pass*, three thousand seven hundred feet high. It passes across the Prairie Provinces through *Edmonton* and *Saskatoon* to *Winnipeg*. East of Winnipeg it runs south of the Lake of the Woods to *Fort William* and then runs north of the Canadian Pacific Railway to *North Bay*, whence it passes through *Ottawa* to *Montreal* and *Quebec*.

Another line of the Canadian National Railways begins at *Prince Rupert* in British Columbia, five hundred miles north of Vancouver. It also passes through the Yellowhead Pass and runs parallel with the other line of the Canadian National Railway to Winnipeg. From this point it is continued across Ontario and Quebec much farther north than either of the other two railways. This railway crosses the St. Lawrence River by a magnificent bridge a few miles above Quebec (Fig. 101), then skirts the southern boundary of Quebec, strikes in a south-easterly direction across New Brunswick, and terminates at *Moncton*. It also runs trains over what was formerly the Intercolonial Railway from Moncton to Halifax.

Another branch of the Canadian National Railways, formerly called the Intercolonial, is the oldest of the government lines. It begins at *Montreal*, runs south of the St. Lawrence River through *Levis*, along the north and east shore of New Brunswick, to *Moncton* and *Amherst*, and thence through Nova Scotia *via Truro*, to terminate at *Halifax*. A branch line runs from St. John to Moncton.

What was formerly the Grand Trunk, is now a part of the Canadian National System. It is the oldest in Canada, and is confined to the eastern provinces. On the west it terminates at *Chicago*. Having crossed the St. Clair River by means of a tunnel, it passes through *Sarnia*, *London*, and *Toronto*. From Toronto it skirts Lake Ontario and the St. Lawrence to *Montreal*. It crosses the St. Lawrence on the Victoria Jubilee Bridge and passes through the southern part of Quebec and the State of Maine to terminate at *Portland* in the United States (Fig. 150).

Sec. 232. Roads. The beginning and the end of the transportation of almost every commodity usually takes place on a road or highway. In Canada we are just beginning to recognise the value of good roads. Accordingly, within the last few years much attention has been paid to their improvement. The Dominion Government

and some of the provincial governments are devoting millions of dollars to assist the municipalities in this work and already a good start has been made.

The People

Sec. 233.—Over one half of the people of Canada are of British origin and over one-fourth are of French origin. The French are found chiefly in the Province of Quebec and the adjoining parts of Ontario and New Brunswick. Small settlements of French are found also in Nova Scotia, Prince Edward Island, and the Prairie Provinces. But the populations of Nova Scotia and Prince Edward Island are predominantly British. The population of the four western provinces includes a large number of people born in foreign European countries. Of these the people of Czecho-Slovakia, Austria, and Hungary predominate, then Russians, followed by Scandinavians (people of Norway, Sweden, Denmark, and Iceland) and Germans. There are considerable numbers of Chinese, Japanese, and Italians in British Columbia. Very large numbers of citizens of the United States are also found in the Western Provinces.

The population of Canada in 1921 was 8,800,000, which was a gain of one million and a half upon the preceding census ten years before. The population is distributed very unevenly. It is almost entirely concentrated on a strip along the south a few hundred miles wide. The population is densest along the southern part of the Atlantic coast, south of the St. Lawrence River, and in the Ontario Peninsula. In these regions there is an average of from ten to seventy-five people per square mile.

CHAPTER XVIII

THE MARITIME PROVINCES

Project

Sec. 234. To study the fisheries of the Maritime Provinces.—In what forms is codfish sold? By reading the label on a package or box of codfish find at what town or city it was packed. Ask your parents how finnan-haddie differs from fresh haddock. Study the pictures of fishes in Figs. 102, 103, 104, and 105, and by means of them identify the different kinds of fish in the shop. Describe the coast-line of the Maritime Provinces (Map 21 in Atlas). Has it many harbours? Of what value are they for fishing? What parts of the ocean and Gulf of St. Lawrence are less than six hundred feet deep? (Map 18 in Atlas.) In what depth of water are the chief fishing grounds found? Locate the chief Maritime fishing ground for cod; for haddock; for mackerel; for oysters; for lobsters; for herring; for halibut; for smelt; and for sardines (Figs. 106 and 110). Which are found close to the coast? In what depth of water are the chief cod fisheries? To which parts of Canada would the Maritime Provinces ship the largest quantities of fresh fish? Why?

Extent and Boundaries

Sec. 235.—Nova Scotia, New Brunswick, and Prince Edward Island, which are called the Maritime Provinces, form the extreme eastern part of Canada. They are small compared with the other provinces, for the three together are not so large as England. Except to the west and north-west of New Brunswick the Maritime Provinces are surrounded by the Gulf of St. Lawrence and the Atlantic Ocean. Their coast-line is therefore very extensive.

Sec. 236. Coast waters (Map 21 in Atlas).—*Chaleur Bay*, the estuary of the *Restigouche River*, extends for one hundred miles between New Brunswick and Quebec. *Northumberland Strait*, which is only about nine miles wide at the narrowest part, separates Prince Edward Island in the Gulf of St. Lawrence from the other Maritime Provinces. The *Strait of Canso* separates the mainland of Nova Scotia from Cape Breton Island. The *Bay of Fundy*, which is skirted both north and south by high, rocky cliffs, extends far

FIG. 102. CODFISH

The most valuable fish of the Atlantic coast. Notice the three fins above and two below.

FIG. 103. HADDOCK

Like the cod it has three fins above and two below, but the black line along the body distinguishes it from other fish.

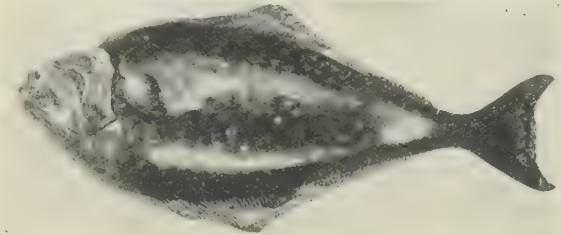


FIG. 104. HALIBUT

Notice the two eyes on the same side of the body. It swims on the side not shown in the picture, which is white.

FIG. 105. MACKEREL

The handsomest of the common food fishes.

(Courtesy of F. C. C. Lynch, Director, Natural Resources Intelligence Branch, Department of Interior.

up between Nova Scotia and New Brunswick, thus increasing greatly the length of their coast-lines. This fine bay at its upper end divides into two branches, in one of which the tides rise higher than in any other body of water in the world (Sec. 64).

The Fisheries

Sec. 237. The coast-line.—Since the surface of the Maritime Provinces has recently been depressed relatively to the sea-level (Sec. 182), the coast-line is so irregular that the very extensive coasts of these provinces are everywhere indented by bays and fringed with islands. Moreover, as one province is an island, another a peninsula, and the third bounded on two sides by water, the length of coast-line is very great in comparison with the size of the provinces.

The remarkable coast-line is of great value to the fishing industry. In the first place, since harbours abound almost everywhere, the fishermen can put out from almost any point on the coast. Again, the shallow water of the bays and harbours is suitable for setting nets for squid, herring, and other small fish, which are necessary as bait for the larger fish caught in deeper waters.

Sec. 238. The banks.—Although many of the larger fish feed on smaller creatures, and these latter feed on still smaller ones, all animal life finally depends on the plants that grow in the water. But since plants require light, which does not penetrate very deeply, the seaweeds are most abundant in shallow water and consequently animal life is most prolific in these regions also. Now, bordering the long coast-line of the Maritime Provinces is one of the widest continental shelves in the world, and the highest parts of it, which are called *banks*, form an admirable feeding ground for fishes (Fig. 106). Moreover, the best food fishes are always found in cold water, such as bathes the coasts of the Maritime Provinces. One can easily see, then, why this region of the Atlantic has become one of the greatest fishing grounds in the world.

Sec. 239. Deep-sea and inshore fishing. There are two chief methods of fishing, the *deep-sea* and the *inshore*. To work by the first method, a vessel of considerable size is required, and on this the crew of ten or fifteen men, who are engaged in fishing, live for weeks or even months at a time, perhaps a hundred miles from the nearest land and often five hundred or more from their home port. They take bait and provisions to last them for a whole trip, which is not ended until their ship is loaded down with the fish which they have caught. Each day the catch is cleaned and

packed in salt beneath decks. Later, when they reach port, the fish are usually spread out to be dried by the sun.

The inshore fisheries are carried on within twelve or fourteen miles from the coast and are more profitable and more convenient for the fishermen. Every morning they go out to the fishing grounds in small motor boats, fish for several hours, and then return the same afternoon with their catch, which is either shipped

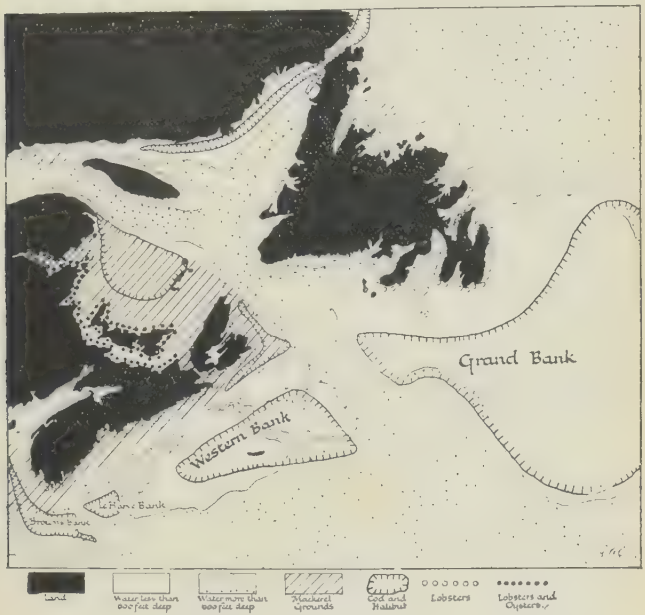


FIG. 106. FISHERIES OF THE ATLANTIC COAST OF CANADA

fresh to Quebec, Ontario, and the New England States, or salted and spread in the sun to dry. The abundant harbours make it possible for the fishermen all along the Maritime coasts to pursue the inshore fisheries, which involve less hardship, require less equipment, and bring larger profits than the deep-sea fishing. Moreover, fish which are dried so soon after being caught are of much better quality than those packed for weeks in the hull of a ship. Consequently the fishermen of the Maritime Provinces devote their chief efforts to this type of fishing. The town of

Lunenburg, however, has a fleet of over one hundred schooners, whose crews share the deep-sea fishing of the Banks of Newfoundland with the fishermen of New England.

Sec. 240. Methods of fishing.—The fish are caught in nets, or by a hook and line, or by a trawl. The trawl consists of a line perhaps a mile long, attached to which at every three or four feet are short lines, each terminated by a hook. The hooks are baited, and the trawl is let down to the bottom, each end being attached to a floating keg. After a time the fishermen, beginning at one end, raise the line, remove the fish, rebait the hooks, and let the line down again. Within the last few years a new and much more

FIG. 107. FISHERMAN LIFTING A LOBSTER POT
Notice the funnel-shaped opening made of netting.

efficient method of fishing has been introduced into Canadian waters. A steamer tows along behind it a funnel-shaped net which skims along near the bottom catching the fish in great numbers. By means of this net, called an *otter-trawl*, the crew of a ship can take much larger quantities of fish in a given time than by the old methods.

Sec. 241. The kinds of fish. The chief fish caught by the methods just described are the cod, haddock, hake, halibut, and pollock (Figs. 102-104). The haddock is either shipped fresh or smoked and dried and sold under the name of *finnan haddie*. Hake and pollock, which are coarser fish than cod, are salted and shipped to the West Indies. The cod, which is much more widely used than any of the others, is shipped fresh, or salted and dried; while some is salted without being dried.

[Courtesy of Canadian National Railways.

FIG. 108. CODFISH SPREAD OUT TO DRY IN THE SUN

Sec. 242. Mackerel and herring.—Close to the shore fishing with nets replaces fishing with lines or trawls. The nets are spread across the path which the fish are known to follow, and in this way many sea-herring and mackerel (Fig. 105) are caught. These are either salted or shipped fresh. Mackerel are caught along all the coasts, except in the Bay of Fundy, but the centre of the herring fisheries is the Bay of Fundy. Small herring are caught in great numbers in *Passamaquoddy Bay* on the south shore of New Brunswick. They are cooked in oil, packed in tins, and sold as sardines.

Sec. 243. Lobsters.—The lobster fisheries of the Atlantic coasts of Canada are the most extensive in the world and are even more valuable than the cod fisheries. In every quiet, shallow bay and harbour around the coast lobster pots (Fig. 107) are baited and sunk to the bottom. These pots work on the same principle as a fly trap. It is easy for the lobster to pass in through the funnel-shaped opening at each end, but it is almost impossible for it to get out. The lobsters are taken at intervals from the traps, cooked, and sealed in tins.

Sec. 244. Oysters.—The oysters of Prince Edward Island and New Brunswick are of the very finest quality. They grow on the shallow, sandy bottoms of estuaries, whence they are dug up by means of dredges and shipped in barrels. Unfortunately, many oyster-beds have been entirely destroyed as a result of over-fishing, but the government is now so restricting itself in the leasing of the fishing grounds that many old beds will soon be replenished, and it is expected that there will be a rapid development of this branch of the fishing industry. At present it is largely confined to Prince Edward Island and New Brunswick (Fig. 106).

Sec. 245. Fishing towns.—*Halifax*, which is centrally situated on the south coast of Nova Scotia, is a centre of trade for the fishing industry. Every town along the coast has its fishing boats, its sheds for drying cod and hake, and its lobster canneries (Fig. 108). The chief occupations of the people are connected with the fisheries.

Surface

Sec. 246. Surface of Nova Scotia.—The Maritime Provinces are in the Appalachian region, and are traversed by the ridges running from south-west to north-east, which are characteristic of the whole Appalachian Plateau (Map 21 in Atlas). These ridges are much lower than in the Southern and the New England States. Nova Scotia is in no part very high, but it is rough and rocky in the southern and western upland portions. The river valleys

[Courtesy of Canadian National Railways.

FIG. 109. SALMON FISHING IN NEW BRUNSWICK

Notice how the game fish has bent nearly double the fishing pole held in the hands of the man sitting. The man in the bow is netting the fish.

in the northern part of the province, and especially the Annapolis valley, have good soil and a suitable climate for agriculture. The rivers with the exception of the Annapolis run north and south to empty into the Atlantic Ocean and the Bay of Fundy, so that they are very short, but, since they have estuaries, are more or less navigable.

Sec. 247. Surface of New Brunswick.—Starting from the south-west corner of New Brunswick, two low ridges run across the province, one along the north shore of the Bay of Fundy through which the St. John River has cut a gorge, the other diagonally across the province from the south-west to the north-east. Between these two ridges is a level region, the bed of a former lake, now occupied by the lower St. John River with its numerous tributary lakes and streams. The land along the river basins is alluvial and very fertile, but the country between these streams and towards the east coast is rocky and wooded.

New Brunswick is one of the best drained regions in the world. So netted is it with rivers that it is possible by making a few short portages to traverse the whole province by canoe. Add to this the fact that the waters are well stocked with salmon and trout and that the forests have more moose, caribou, deer, duck, woodcock, and other game to the square mile than any other part of Canada, and it will be readily understood why the province is called the sportsman's paradise (Fig. 109).

Sec. 248. The St. John is one of the great rivers of Canada. It rises in the State of Maine and flows diagonally across the province, having waterfalls, rapids, and gorges in its upper course and expanding at its mouth into the commodious harbour of St. John. Here its meeting with the Bay of Fundy tide effects a unique phenomenon. Just above the harbour the river flows through a narrow gorge in a fall of fifteen feet. The river becomes level as the tide rises and at high tide the water tumbles down a fall of ten feet in the opposite direction. The river is navigable for a good part of its course in New Brunswick, and since it flows through a heavily timbered region, is of the highest value to the lumber industry.

Sec. 249. Surface of Prince Edward Island.—The whole surface of Prince Edward Island is comparatively level, and the soil is extremely fertile. As a result practically the whole island is under cultivation.

Agriculture

Sec. 250. Since the springs are late in the Maritime Provinces, and early frosts, especially in New Brunswick, are not uncommon,

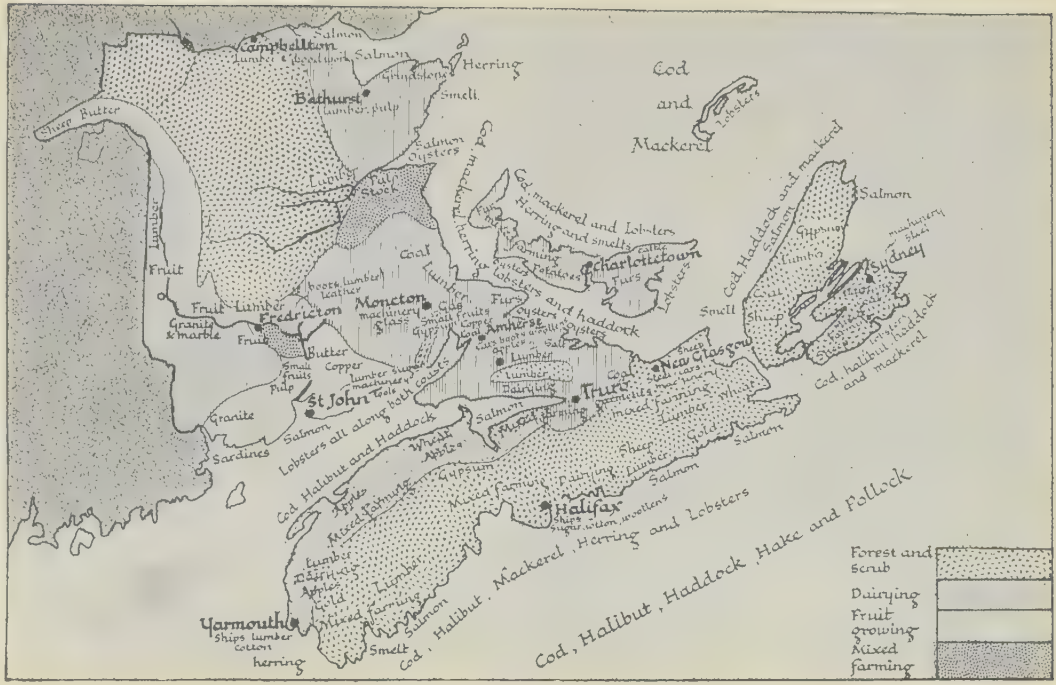


FIG. 110. ECONOMIC MAP OF THE MARITIME PROVINCES

the climate is not suitable for the growth of wheat. The chief crops are potatoes, hay, oats, and turnips. Mixed farming is extensively carried on and is steadily increasing (Fig. 110).

Much fruit is grown in Nova Scotia and southern New Brunswick. The Annapolis valley in Nova Scotia, which is one hundred miles long and ten miles wide, is protected from the winds by high ridges on both the north and the south. The congenial climate and fertile soil make it a most notable district for the production of apples (Figs. 111 and 118). A visitor has said that it is possible to drive for fifty miles in the valley under apple blossoms. The apple industry in this valley has been thoroughly organised on scientific principles, and as a result the product commands the highest price in the British market.

The most fertile parts of New Brunswick are the wide valleys of the rivers (Fig. 110). The higher land between them is rough, and there is much stony and sandy land in the interior of the province.

Prince Edward Island, called the "Garden of the Gulf," is one of the best agricultural districts of Canada (Fig. 110). The whole island is divided into farms upon which live the most contented, happy people to be found anywhere in Canada. They are intelligent, prosperous, thrifty, and own their own farms. Though there are few wealthy people, there is no poverty.

Sec. 251. Fur farming.—A few years ago it might have been said that there were no large fortunes to be made in Prince Edward Island, but to-day as a result of fox farming a number of people have become suddenly wealthy. Because the fur-bearing animals in the unsettled parts of Canada are becoming more difficult to obtain and seem destined soon to disappear, a new method of obtaining fur must be adopted. Some enterprising farmers on Prince Edward Island have therefore undertaken the domestication of the silver-black fox. The endeavour has been successful, and many ranches have been established, on which foxes have been raised which have sold as high as twenty thousand dollars a pair (Fig. 112). The pelt of a silver-black fox from one of the ranches is much superior to the pelt of a wild fox and brings a very high price. The industry has become so extensive that to-day the commercial value of the domesticated foxes is more than one-fourth as great as that of all cattle, horses, sheep, swine, and poultry on the island.

Lumbering

Sec. 252. New Brunswick and Nova Scotia have very large areas covered with forests, and the numerous streams offer excellent

[*Courtesy of Nova Scotia Department of Agriculture.*

FIG. 111. PICKING APPLES IN ANNAPOLIS VALLEY, NOVA SCOTIA

[Courtesy of Canadian National Railways.

FIG. 112. TWO SILVER-BLACK FOXES IN THEIR PEN ON A FOX FARM, PRINCE EDWARD ISLAND
Their keeper is feeding them.

facilities for floating the logs down to the saw-mills. In New Brunswick, particularly, this industry is of vital importance (Fig. 110).

Mining

Sec. 253.—The chief mineral obtained in the Maritime Provinces is *coal*, and since no coal is found in Quebec or in the New England States there is a ready market for this mineral. In fact the whole soft coal supply of Prince Edward Island and New Brunswick, as well as a good part of the supply of Quebec, comes from the coal mines of Nova Scotia, which are located at *Springhill*, south of Amherst, and at *Sydney* (pop. 22,000) and *Glace Bay* (pop. 17,000) on Cape Breton Island. A small amount of coal is also mined in New Brunswick (Fig. 110).

Manufacturing

Sec. 254.—With a supply of coal at their very door, and such excellent facilities for ocean transportation, it might be thought that the Maritime Provinces would have many important manufacturing establishments. But owing to the fact that they are far away from the chief centres of population in Canada and that manufactured goods would have to be largely sold in the home market, which is not a very large one, these industries are not as yet greatly developed. However, in recent years a marked improvement has taken place. *Sydney*, on Cape Breton Island, produces much iron and iron goods from ore brought from Newfoundland and smelted in blast-furnaces by means of the coal mined in the district.

In *Amherst* (pop. 9 900), *New Glasgow* (pop. 8 900), and *Halifax* in Nova Scotia, and in *St. John* and *Moncton* (pop. 13,000), New Brunswick, there are large manufacturing establishments (Fig. 110).

Sec. 255. Transportation.—The admirable facilities for water transportation, together with a supply of excellent timber, have made the Maritime Provinces famous for the building of wooden ships. In fact, there were more shipowners in proportion to their population than in any other region in the world. But the coming of iron ships somewhat checked their prestige in this respect. As to railways, besides the two main lines of the Canadian National Railways and the Canadian Pacific, which have been described already (Sec. 231), there is a branch of the Canadian National Railways which runs east from the main line at Truro, Nova Scotia, crosses the Strait of Canso by means of a car ferry, and terminates at Sydney. There is also a branch of the Canadian National Railways in Prince Edward Island.

FIG. 113. HALIFAX HARBOUR [*Courtesy of Canadian National Railways.*

Notice the great size of the harbour, which is also a naval station.

Cities and Towns

Sec. 256.—Most of the cities and towns of the Maritime Provinces have been already mentioned in the description of the various industries. *Halifax* (pop. 58,300), the capital of Nova Scotia, is chiefly important on account of its excellent harbour, which is open all the year round (Fig. 113). For this reason it is one of the great ocean ports of Canada and is the terminus of the Canadian National Railways. On account of its harbour and docking facilities it is the chief American Naval Station in the North Atlantic for the British Fleet.

The harbour of *St. John* (pop. 47,100) is free from ice throughout the winter, largely on account of the high tides, which prevent any permanent covering of ice from being formed. St. John shares with Halifax the distinction of being a leading winter port of Canada. Though it surpasses Halifax in the amount of its exports, the amount of its imports is less. As a port it has one advantage over Halifax in that it is several hundred miles nearer the central and western part of Canada. But its harbour is smaller and the approach more dangerous.

Fredericton (pop. 8,000) on the St. John River, the capital of New Brunswick, and seat of the provincial university, is an attractive residential town.

Charlottetown (pop. 12,300), the capital of Prince Edward Island, is beautifully situated, and is the commercial and social centre of the island.

Population

According to the census of 1921, the population of the Maritime Provinces was slightly over one million. Of this, there were in Nova Scotia 523,800; in New Brunswick, 387,900; and in Prince Edward Island, 88,600. The increase over the preceding census was, in Nova Scotia, over 6 per cent.; in New Brunswick, over 10 per cent.; while in Prince Edward Island there was a decrease of over 5 per cent. The proportion of the people living in towns and villages to those in rural parts was, in Nova Scotia, about 1 to 1·3; in New Brunswick, about 1 to 2; and in Prince Edward Island, about 1 to 3.

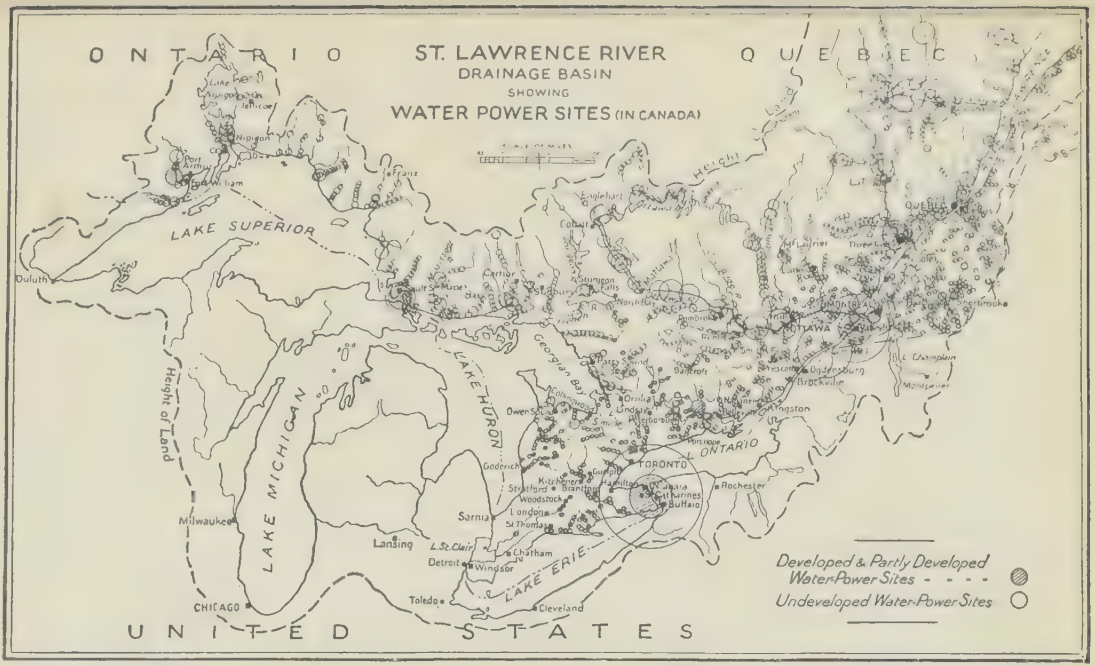
CHAPTER XIX

PROVINCE OF QUEBEC

Projects

Sec. 257. To study the hydro-electric power of Quebec and Ontario.—Examine Fig. 114. What do the white circles indicate? What do the dark circles indicate? What is the significance of the relative sizes of the circles? What phenomena in rivers make them suitable for developing water-power? Which river, in the region mapped, has the greatest amount of water-power? What is the source of the water-power at Sault Ste Marie? What are the sources of power in the Niagara River? Why is the water-power of the Niagara River so much greater than that of St. Mary's River? What large cities in Ontario would probably be served with electrical power from Niagara Falls? Where are the greatest centres of water-power of the St. Lawrence River? What great city are they near? Of what value is it to have such water-power near at hand? Find Shawenegan Falls on the St. Maurice River. How far is it from Montreal? Montreal obtains electrical power from this source. How many sources of water-power are situated on the Ottawa River? At how many of them is the power utilized? Explain why so much of the water-power on the Ottawa River is not utilized. Name the cities and large towns of Ontario and Quebec that have adequate supplies of water-power near at hand, say not more than thirty miles away. How does this give them advantages over other towns and cities? Find the water-power nearest to the place where you live. Is it utilized? If so, for what purpose? Try to visit this source of water-power and find out how it is used to generate power. If you have electric lights in your home, find out how and where the electricity is generated.

Sec. 258. To study the City of Montreal.—Study Fig. 123 to find the position of the rapid or falls farthest down the St. Lawrence River. Are there any falls or rapids in the St. Lawrence below Montreal? Is there anything to prevent the ocean steamers ascending the St. Lawrence above Montreal? Basing your reason on the answers to the last two questions, state why Montreal should be a great commercial city. Examine Map 19 in the Atlas and state what railways pass through Montreal. On the school



[Specially prepared for this book by the Dominion Water Power Branch of the Department of the Interior, Ottawa.

FIG. 114. HYDRO-ELECTRIC POWER OF ST. LAWRENCE BASIN

The relative horse-power capacity is approximately shown by the varying sizes of the circles.

globe compare the distance from Montreal to Liverpool with the distance from New York to Liverpool (Fig. 90). Compare the distance from the wheat region of Western Canada and the United States to Liverpool *via* Montreal and *via* New York. In which case would there be the longest haul on the railway? What two advantages has Montreal over New York as a port for shipping western produce? Read the list of Canadian imports in Sec. 229 and state which of them will probably come *via* Montreal. What exports of Canada (Sec. 228) will probably pass through Montreal? What disadvantage does Montreal suffer during the winter?

Extent

Sec. 259.—The recent addition of the Canadian part of Labrador Peninsula to Quebec has made it the largest of the provinces (Map 17 in Atlas). It is not only larger than any country in Europe except Russia, but surpasses in size France, Germany, and Italy combined.

It has a greater extent of sea-coast than any other province. Hudson and James Bays wash its western side for over nine hundred miles, and Hudson Strait and Ungava Bay bound it on the north. It is true that the bleak Labrador coast cuts off much of the eastern part of Quebec from the Atlantic, but this is more than compensated for by the fact that the Gulf and River St. Lawrence, like a great arm of the sea, extends to its very centre. On the south the Bay of Chaleur forms more than half of the boundary between Quebec and New Brunswick. The Ottawa River for a great part of its course flows between Quebec and Ontario. But near its mouth the boundary strikes south so as to include within Quebec the point of the angle at the confluence of the St. Lawrence and Ottawa Rivers. On the south Quebec is in contact with the United States for a distance of four hundred miles.

People

Sec. 260. Early history.—Colonised by France in the seventeenth century, Quebec has ever since retained her French language and culture and has been a radiating centre of French settlements. Under the rule of France her pioneers spread along the Great Lakes and the Ohio Valley as far as the Mississippi River. Since the British conquest, her French population has increased from a few thousand to a million and three-quarters and has overflowed into New England and Ontario.

Sec. 261. Population.—In 1921 Quebec had a population of about

2,300,000 people, which was a gain of fifteen per cent. over the population of 1911. This considerable increase was not due to any great influx of immigrants but to the natural increase of births over deaths. No province in the Dominion is freer from foreign elements in its population, over ninety-two per cent. of the people being native-born.

Over eighty per cent. of the people are of French extraction, the remainder being largely English, Irish, and Scots. The English-speaking population is scattered along the whole southern border of the province. The French, Irish, and Indians are almost entirely Roman Catholics, the English are mainly Anglicans and Methodists, and the Scots Presbyterians.

Sec. 262.—The people of French descent have preserved many of the customs of the time when Canada was a colony of France. The French-Canadian is a steady, intelligent, handy workman. He can do as many things with a sharp axe as an ordinary carpenter with a whole kit of tools. He is devoted to the spot where he was born, and rarely wanders far away. Consequently Quebec has contributed less than other provinces to the settlement of Western Canada. When the French-Canadian leaves his home he prefers to go to the factories of the adjoining New England States, from which he can readily return to his native town or village. Although in the past he has been unprogressive, a rapid change has recently taken place, and he is now adopting new methods on the farm and in business. Already his surroundings have improved, and the products and prosperity of the province are rapidly increasing.

The magnificent Roman Catholic churches thickly scattered over the province are the outward signs of a Roman Catholicism unsurpassed anywhere in the world for devotion.

Sec. 263. The Eastern Townships.—The border district of the province east of Montreal was originally settled by English-speaking people, who, on account of the excellent land and timber, emigrated at the beginning of the nineteenth century from the United States. They were given land and became progressive farmers. But the French-Canadians are steadily supplanting them, and many of them have sold their farms and either moved to Ontario and the Western Provinces or settled in the cities.

Natural Divisions

Sec. 264. The Laurentian region.—The Canadian Shield, which has been fully described (Secs. 203 to 208), occupies the northern part of the province. Its southern boundary runs close to the north shore of the Gulf and River St. Lawrence from Labrador almost to the city of Quebec (Fig. 93). West of this it diverges

from the river and passes thirty miles to the north of Montreal. These Laurentian Highlands are so steep on the southern slope that, viewed from the St. Lawrence River, they appear to rise in the distance as a range of mountains. They are usually called the *Laurentide Hills*. Down their steep southern slope the rivers tumble in many rapids and cataracts.

The *Hamilton River*, which is important on account of the large deposits of iron-ore found in its vicinity, empties into *Hamilton Inlet* on the Labrador coast. It is proposed to develop these deposits of iron by means of the electrical power obtainable from the waterfalls in the course of the river. This part of Quebec is covered with forests, which furnish the material for the lumbering industry of the province. The logs are cut far away in the unsettled regions of the interior and are floated down on the swift tributaries of the St. Lawrence to be cut into lumber and ground into pulp at suitable shipping points (Fig. 115). Pine, spruce, hemlock, and cedar are all extensively used for the manufacture of lumber, but spruce is most valuable for pulp, of which Quebec produces more than any other province (Fig. 119).

In the more northern parts of the Laurentian region the scattered population consists of hunters and trappers.

Sec. 265. The Appalachian region.—The parallel ranges of the Appalachian Mountains as they enter the south of Quebec from the States of New Hampshire and Vermont gradually decrease in elevation. They pass along the eastern part of Quebec as a series of low hills, which give the country a rolling appearance. They reach the St. Lawrence River below Quebec and then run parallel to it right out to the end of the Peninsula of *Gaspe*. In this peninsula they rise to a height of almost 4500 feet, which altitude is attained nowhere else in the province except in the extreme north-east of Labrador Peninsula.

The chief mining of the province is carried on in the Appalachian region. Quebec supplies almost the whole world with asbestos. This mineral, obtained at *Thetford Mines* (pop. 7,800) and its vicinity in Megantic County, is shipped both to Great Britain and to the United States (Fig. 119). Copper is also extensively mined in the south-western part of the Appalachian region, not far from the mines where asbestos is obtained (Fig. 119).

Sec. 266. The St. Lawrence Plain.—The Canadian Shield and the Appalachian Highlands border the north and south shores of the St. Lawrence River from its mouth to the vicinity of Quebec. Here they diverge and recede from the river. A flat, wedge-shaped plain lies between them, divided into two parts by the St. Lawrence River. On this plain resides by far the largest part of the population of Quebec.

FIG. 115. LOGS ON THE MADAWASKA RIVER IN QUEBEC [*Courtesy of Canadian National Railways.*

Find the Madawaska River on the map. Are the logs large or small? Do they entirely block the river channel? From Fig. 93 find in which natural division the region depicted is situated. Is this region level or rough? Describe the appearance of the hills.

The flat surface of this plain leads one to believe that it is an old sea-bed (Sec. 126). The fossil remains of marine animals found in its sediments confirm this belief, as do the old beaches which encircle Mount Royal. This is the most westerly of a row of seven isolated hills, which rise like pyramids from the flat plain. These relics of the distant past are really the remains of volcanoes that at one time belched out destruction on surrounding regions. The softer parts of the volcanic cones have long since been worn away, and nothing is left behind but the remains of the harder lava plugs, which filled the craters.

This plain, which is one of the best agricultural regions of Canada, is largely parcelled out into farms. French-Canadian farms differ in shape from those of the rest of Canada. They are very long, narrow strips of land running back from some river or important road. Hence the farm-houses which are built along the border of the road or river stand close together, running in a narrow line for mile after mile. Occasionally the narrow line thickens into a mass of buildings to form a village.

The French-Canadian farmers were formerly unprogressive and often cultivated their fields as their ancestors had done two hundred years ago (Fig. 116). But they are adopting new methods and new machinery and have already achieved wonderful results. The chief crops are oats, potatoes, and hay. But they are also turning to mixed farming, and already Quebec is unrivalled in Canada in the production of creamery butter, and is surpassed only by Ontario in the production of cheese. Quebec has led for many years in the production of tobacco, every farm growing a little, but recently she has been almost equalled by Ontario. The maple sugar and maple syrup industry is also largely centred in Quebec (Fig. 117). Though the climate is too severe for some of the more tender fruits, it is suitable for apples, pears, plums, and cherries. Orchards are found throughout the St. Lawrence Plain (Fig. 118).

The River St. Lawrence

Sec. 267.—The River St. Lawrence is the main artery of Eastern Canada. Nowhere in the world is there a river with an estuary so wide, with water so clear, and with scenery so varied and beautiful. One must sail up its estuary for a hundred miles before both shores appear in view, indicating that the traveller is really in a river. At the foot of the *Island of Orleans* the channel is still ten miles wide, and the water is so deep that the largest vessels afloat can sail with ease as far as Quebec.

[*Courtesy of Canadian National Railways*

FIG 116. FRENCH-CANADIAN FARMS AT CACOUNA

What shape are the farms? Where are the houses? What forms a row down the middle of each farm? What are the disadvantages of such long narrow farms? What are the advantages? Try to find out why French-Canadian farms have this shape.

From Quebec to Montreal the river has an average width of two miles and an average depth of about fifty feet. But *Lake St. Peter*, an expansion of the river about thirty miles long and seven miles wide, has an average depth of less than ten feet. By the dredging of this and other shoals a thirty-foot channel has been obtained as far as the City of Montreal.

The wooded *Island of Anticosti* stands guard at the entrance to the river, and many islands are to be found in the channel, the most important being Orleans, just mentioned, below Quebec, and the *Island of Montreal* at the mouth of the Ottawa.

Sec. 268. Tides.—The tidal wave is only six feet high at Anticosti. As the river narrows it rapidly rises until at the lower end of the Island of Orleans it is nineteen feet high. It is not much lower at Quebec. Above Quebec it has spent its force and rapidly diminishes, finally exhausting itself at Three Rivers. The rise and fall of the tides is accompanied by powerful tidal currents, which occasionally have a velocity of eight miles an hour.

Sec. 269. Salinity.—In spite of the vast quantities of water swept down by the St. Lawrence—two million gallons every minute—the force of the tidal wave carries the salt water up stream almost to Quebec.

Sec. 270. Fishing.—Fishermen's huts are to be found in every little cove or sheltered place along both sides of the St. Lawrence estuary. The French-Canadian fisherman puts out every morning in a small boat to fish for cod with hook and line or with a trawl, and returns in the afternoon with his catch. Mackerel and herring are also taken in nets. All the streams emptying into the estuary are well stocked with magnificent salmon, and furnish excellent sport for the numerous sportsmen who visit their shores during the summer (Fig. 119).

Sec. 271. Commerce.—In many respects Quebec is the most fortunately situated of any of the provinces with regard to transportation. She has a great stream navigable for the largest ocean liners, flowing through the most populous part of her territory. All the over-sea trade between Europe and those parts of Canada west of the Maritime Provinces passes through the St. Lawrence, and Montreal exports more grain than any other city in North America.

Sec. 272. Tributaries. The St. Lawrence has many large tributaries flowing in from both the north and the south. Some of these streams, especially those from the north, have rapids and waterfalls, so that they are only of limited value for navigation. But many millions of logs are floated down these rivers from districts far back on the brow of the Canadian Shield (Fig. 115).

The *Saguenay*, *St. Maurice*, and *Ottawa* are the most important

FIG. 117. MAPLE SUGAR MAKING IN QUEBEC [*Courtesy of Exhibits and Publicity Bureau, Department of Trade and Commerce, Ottawa.*

Notice the pails attached to the trees, with covers to keep the sap clean. Men gather the sap each day. Is all the snow off the ground? What season of the year is it?

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northern tributaries. The *St. Francis* and *Richelieu* are important tributaries on the south.

The Saguenay is the deepest and gloomiest river in the world. For almost sixty miles its black waters flow between treeless cliffs

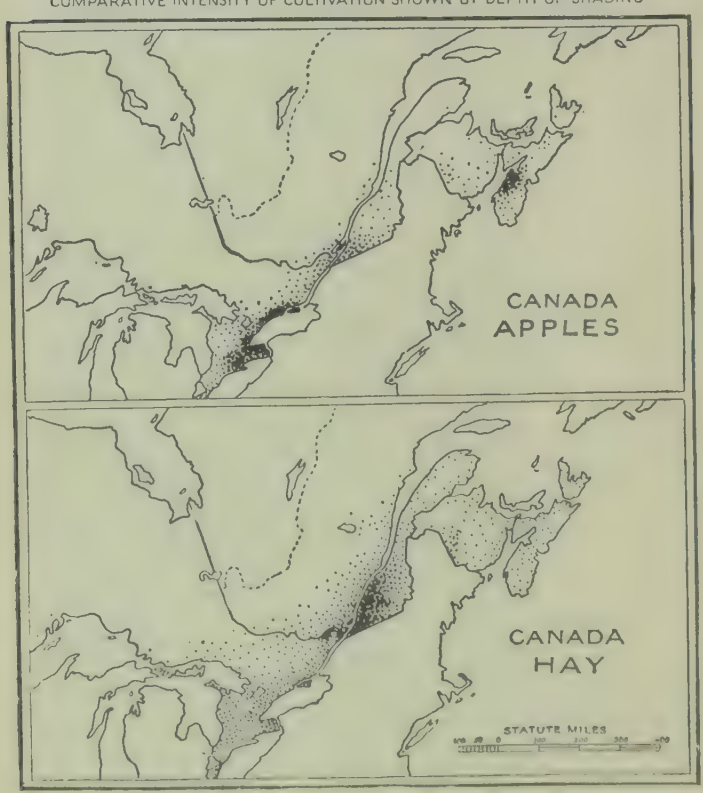


FIG. 118. APPLE AND HAY PRODUCTION OF EASTERN CANADA

Where are the chief apple-producing districts? Which province produces the most apples, and which produces the most hay?

more than one thousand feet high, the most magnificent of which are *Capes Trinity* and *Eternity* (Fig. 120). It finally empties into the St. Lawrence River. Its upper course from Lake St. John, where it rises, to *Chicoutimi* at the head of navigation, is checked by many rapids and waterfalls. Below Chicoutimi it is

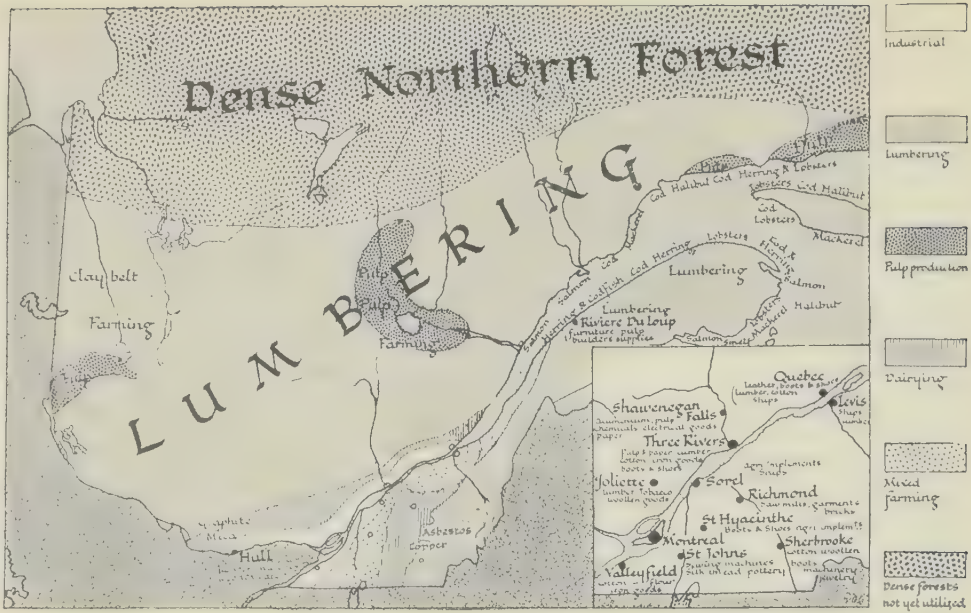
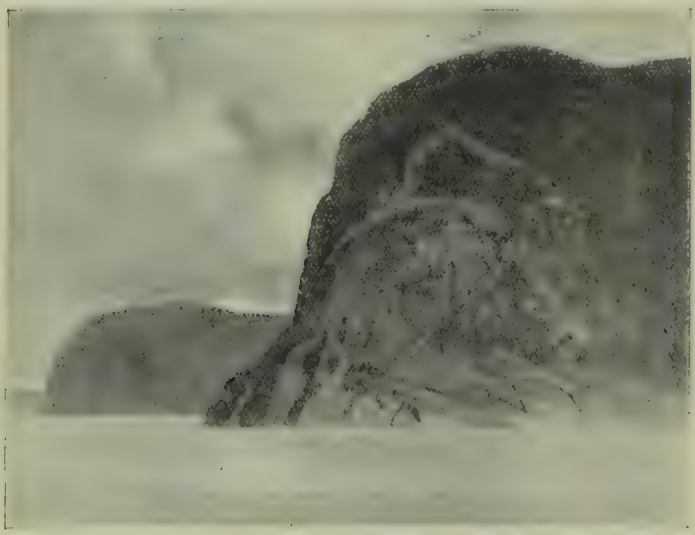


FIG. 119. ECONOMIC MAP OF QUEBEC

without rock or shoal, and is navigable for the largest ships afloat. At its mouth it is four hundred feet deeper than the St. Lawrence.

The *St. Maurice* is an important river, which empties into the St. Lawrence at *Three Rivers* (pop. 22,300), which has important saw-mills and ship-yards. About twenty miles up the river is *Shawenegan Falls*, from which much electrical power is developed. Some of this is transmitted to Montreal, but a large amount of it is utilized in *Shawenegan Falls* (pop. 10,600). Where there are



[*Courtesy of Canadian National Railways.*

FIG. 120. CAPES TRINITY AND ETERNITY ON THE COURSE OF THE RIVER SAGUENAY

From a painting by C. W. Jefferys. One of the most impressive sights in Canada.

manufactures of aluminium, pulp, paper, and calcium carbide. The last substance is used for making acetylene gas.

The *Ottawa River* is navigable as far as the city of Ottawa at the *Chaudiere Falls*. There are numerous navigable stretches farther up the river. Between these are many rapids and falls, which are capable of developing much electrical power (Fig. 114). *Hull* (pop. 23,800), which is a suburb of Ottawa, is the chief town on the river. It is the centre of the lumbering industry, and wooden-ware and matches are manufactured in large quantities.

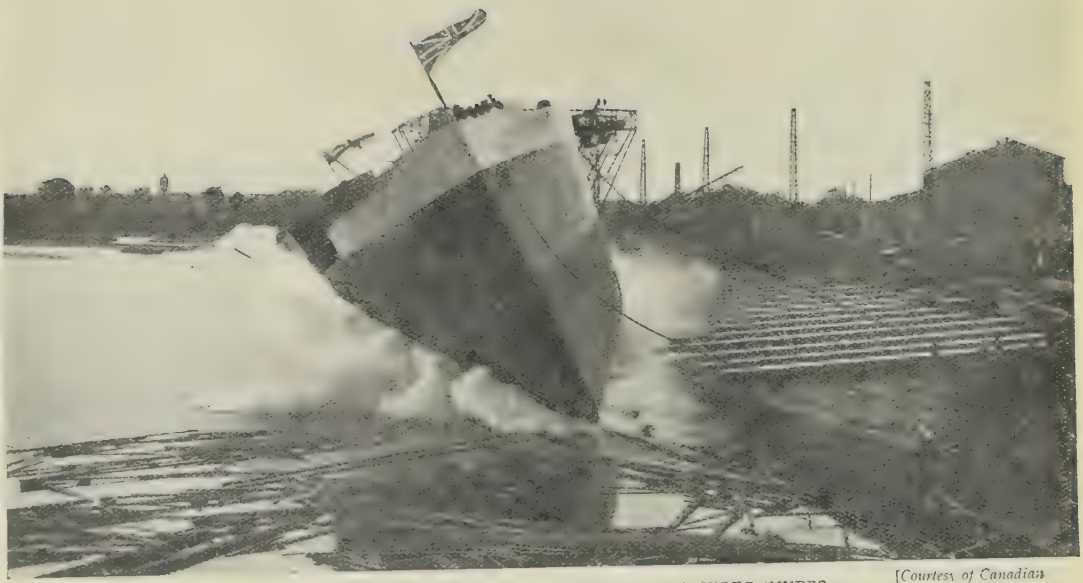


FIG 121. LAUNCHING OF A STEEL SHIP AT THREE RIVERS

[Courtesy of Canadian National Railways.

This is one of the ships belonging to the Canadian Government Merchant Marine. It is just slipping into the water. Notice the slanting timbers, which were well greased in order to allow the ship to glide gently from where it was built on the shore into the channel. What is the name of the river into which it is gliding?

Manufacturing

Sec. 273. Manufactures.—Quebec has better facilities for manufacturing than any other province. The St. Lawrence brings the largest ocean liners to her very door, so that she is unrivalled in her facilities for transportation. Moreover, the water-power of Quebec is as great as that of Ontario, her only rival in this respect, and much of it is conveniently near the centres of population and commerce. Further, the French Canadian population abounds in intelligent, alert workmen. Thus, in regard to transportation, power, and labour, Quebec is admirably adapted to be a leading manufacturing province.

The chief manufactures at present are lumber, pulp, paper, boots and shoes, cotton, refined sugar, and flour (Fig. 119).

Sec. 274. Manufacturing towns.—Some of the manufacturing towns have been mentioned already. Among the others, *Joliette* (pop. 9,000), north-east of Montreal, has woollen mills, paper mills, and tobacco factories; *St. Hyacinthe* (pop. 10,800) on the Yamaska River manufactures boots and shoes and agricultural implements; *St. Johns* (pop. 9,800) on the Richelieu River manufactures sewing machines; *Sherbrooke* (pop. 22,000) in the Eastern Townships is the commercial centre of a thriving agricultural region. It also manufactures boots, cottons, woollens, and a great variety of other goods; *Sorel* (pop. 8,000), at the mouth of the Richelieu, has a shipyard; *Valleyfield* (pop. 9,180), west of Montreal on the south side of the St. Lawrence River, has large cotton and flour mills; *Lachine* (pop. 15,400) and *Verdun* (pop. 24,800), west of Montreal, are really suburbs of that city. They have numerous manufactures.

The Cities of Montreal and Quebec

Sec. 275. Montreal is the largest and most important city in Canada. Its population in 1921 was 607,000. It is situated on the south-east side of the Island of Montreal and has Mount Royal towering up behind it 750 feet high. The city is now steadily expanding around the mountain. Over one-third of the total exports and imports of Canada pass across the docks of this great centre. The Canadian Pacific and three of the main divisions of the Canadian National Railways (which were formerly the Canadian Northern, the Grand Trunk, and the Intercolonial Railway) act as feeders for the ocean traffic and also distribute the imports to the west and east. The Victoria Jubilee Bridge,

FIG. 122. QUEBEC CITY FROM THE CITADEL [*Courtesy of Grand Trunk Railway.*

The promenade on which numerous people are walking is Dufferin Terrace, the large building to the left is the Château Frontenac. The buildings on the lower level are in "Lower Town." What is the name of the river?

which spans the river at Montreal, is used by the Canadian National Railways. Farther west is a fine trestle bridge constructed by the Canadian Pacific Railway.

Montreal is not only the commercial but also the industrial and financial centre of Canada. There are over 1400 factories, in which are manufactured boots and shoes, refined sugar, flour, cement, tobacco, rubber, iron and steel, silk, cotton, electric goods, and many other articles. Moreover, a majority of the great banks and insurance companies of Canada have their headquarters in this city.

Montreal possesses many beautiful buildings. Notre Dame Church, a very handsome structure, can accommodate ten thousand worshippers. In one of its two magnificent towers it has the largest bells in America. St. James' Basilica, another Roman Catholic edifice, is a model of St. Peter's in Rome, but only one-half its size. McGill University is housed in a dignified group of buildings at the base of Mount Royal. The University of Montreal has recently replaced a branch of Laval University, whose headquarters are at Quebec.

Sec. 276. Quebec (Pop. 94,000) is the most picturesque city in America. Its commanding situation, crowded gray stone buildings and frowning fortifications suggest some historic town of the old world. Part of the city is perched on the high, rocky ledge of Cape Diamond, which lies in the angle between the St. Lawrence and its tributary the St. Charles. At the point of the Cape stands the famous citadel, a walled fortress of an ancient type. This Gibraltar of the New World, which commands the channel down the river, has seen more battles than any other spot in Canada. At the foot of the citadel is huddled the Lower Town with its old houses, narrow streets, and winding passages. The humbler dwellings and many of the business houses are situated here; but the churches, hotels, and finer residences are on the higher land above (Fig. 122).

The city has grown very slowly, but during recent years its industrial development has been great. It has lost much of the lumber trade, and the deepening of the St. Lawrence channel has tended to send the ships up to Montreal. However, the largest and fastest passenger steamers, in order to avoid the dangers of the upper St. Lawrence, make Quebec their terminus. This city now has a considerable number of important industries. Cotton goods, boots and shoes, and many articles made of iron, such as castings, machinery, cutlery, and nails are manufactured here.

The provincial parliament buildings and the buildings of Laval University are handsome structures. Quebec, which is the centre of French and Catholic life in Canada, has some splendid churches.

Transportation

Sec. 277. Railways.—The chief railways have been already described (Sec. 231). Throughout the southern part of the province there are many local lines. Branches of both the Canadian Pacific and the Canadian National Railways run north of the St. Lawrence River from Montreal to Quebec. A further branch of the Canadian National Railways strikes north to Lake St. John.

Sec. 278. Roads.—During recent years no province has devoted more attention to the improvement of its roads than Quebec. Consequently she has now some of the best roads in Canada.

CHAPTER XX

ONTARIO

Projects

Sec. 279. To study the Great Lakes.—Make an accurate sketch of the Great Lakes and the St. Lawrence River as far as Montreal (Map 20 in Atlas). Print the names of the lakes, and mark in their altitudes, which are as follows: Superior 602 feet, Huron 581 feet, Erie 572 feet, Ontario 246 feet, St. Lawrence at Montreal 27 feet. Through what river does Lake Superior discharge into Lake Huron? (Fig. 123.) What is the length of this river? (See scale in Map 20 in Atlas.) How many feet does the water fall in passing through the river? Will the current be swift? How do boats avoid these obstructions? (Fig. 124.) What will be the speed of currents in the St. Clair and the Detroit Rivers? How many feet does the water fall in flowing through the Niagara River? Where does a large part of the drop take place? Since the height of Niagara Falls is 155 feet, how much fall is there along the rest of the river? What phenomena will this produce in the river? How are these difficulties to navigation overcome? What is the fall of the water in the St. Lawrence River between Lake Ontario and Montreal? Would rapids be likely to occur in this part of the St. Lawrence? Observe the canals by which these are passed. Mark on your map in red the canals along the Great Lakes (Fig. 123). What is the chief Canadian port on Lake Superior? What railways from the west enter this port? Why has this port such great elevators? (Fig. 126.) The grain from Fort William is carried by steamers to *Depot Harbour*, *Port McNicoll*, *Goderich*, *Montreal*, and *Buffalo* (Fig. 123). Mark these ports on your map and mark also the railways by which grain is carried from the first three to Montreal. From the scale in Map 20 in the Atlas measure the greatest length and greatest width of each lake and calculate roughly the area of each. Compare the size of each of the Great Lakes with that of England, the area of which is about 51,000 square miles. Which connecting rivers have deltas at the mouth s? What islands are situated at the point where the Canadian Shield crosses the St. Lawrence River? Of what kinds of rock are these islands composed? (Sec. 204.)

Sec. 280. To study the productions of Ontario.—After examining

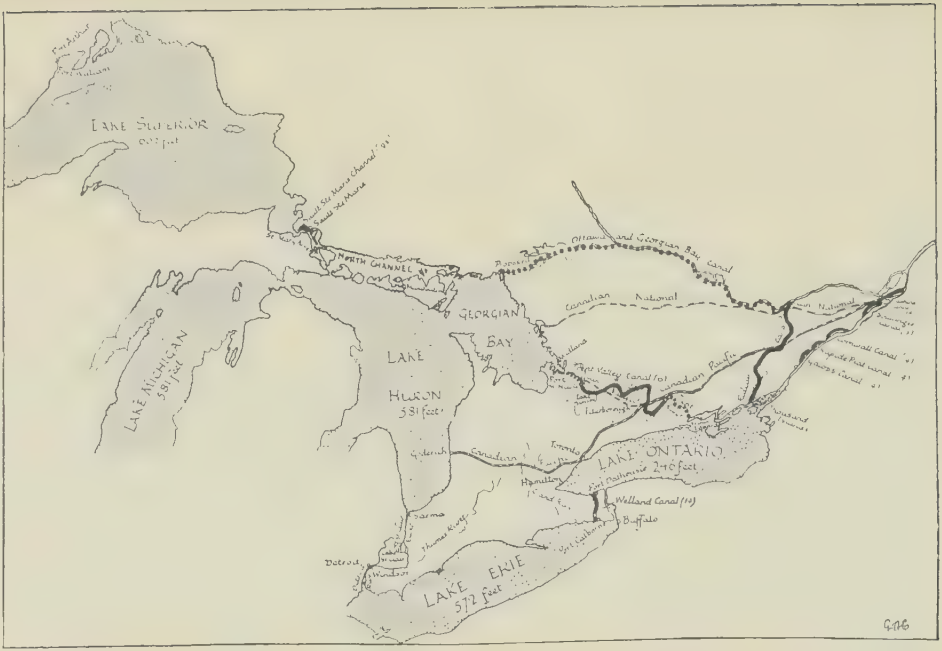


FIG. 123. MAP OF THE GREAT LAKES, SHOWING CANALS, PORTS, GRAIN ROUTES, AND CHIEF RIVERS

The parts of incomplete canals are represented by broken lines. The numbers after the names of the canals indicate the depth of water in feet.

Fig. 99 write down a list of the mineral products of Ontario and state in what part each is found. From Sec. 226 find in which of these minerals Ontario's production exceeds that of every other province. From Fig. 98 compare Ontario's wheat production with that of the other provinces. In what parts is wheat largely grown? From Fig. 98 state in what parts of Ontario the greatest quantity of wheat is raised. Compare the production in Ontario of wheat and oats (Fig. 98). Which has the greater production of oats, Ontario or Quebec? Compare the production of hay in Ontario with its production in Quebec (Fig. 118). In what parts of Ontario are cattle most extensively raised? (Fig. 130.) In what part of Quebec? Which produces the greater number of cattle, Ontario or Quebec? Locate the chief swine-producing regions of Ontario (Fig. 130). Locate the chief apple districts of Ontario (Fig. 118). What other apple districts are there in Eastern Canada?

Size and Boundaries

Sec. 281. Size and shape.—Though Ontario is less than two-thirds as large as Quebec it has an area greater than that of any of the remaining provinces of Canada. It is more than three times as large as the British Isles and much larger than France and Germany together.

The shape of Ontario has been compared to that of Italy (Fig. 199). Both are boot-like, but in Ontario the upper part of the boot is very wide. The foot, which is enclosed by the lower lakes and the St. Lawrence River, measures five hundred miles from the toe at Windsor to the heel at Cornwall. This portion is usually spoken of as *Old Ontario*, and the much larger leg of the boot to the north is called *New Ontario*.

Sec. 282. Boundaries.—The southern border of Ontario for over sixteen hundred miles is washed by the Great Lakes. Beyond these lie the States of New York, Pennsylvania, Ohio, and Michigan. West of Lake Superior, Ontario is separated from the United States by a number of swift rivers with many lake expansions, the farthest west of which is the *Lake of the Woods*. Manitoba is in contact with the western border of Ontario from the Lake of the Woods to Hudson Bay. Hudson and James Bays wash the northern coast of the province for six hundred miles. Ontario touches Quebec from the head of James Bay to the source of the Ottawa River. The two provinces are separated by this river throughout the greater part of its course. Near the confluence of the Ottawa and St. Lawrence Rivers, however, the boundary of Quebec strikes across the former river and cuts off two counties from the angle between these rivers.

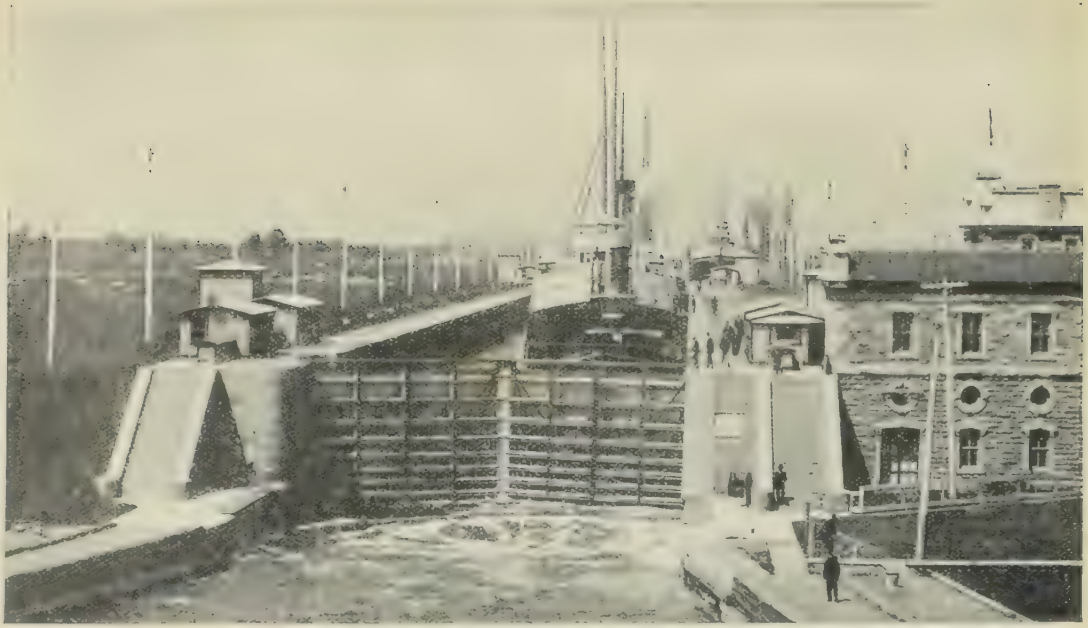


FIG. 124. THE CANADIAN LOCK AT THE SAULT CANAL [*Courtesy of Canadian Pacific Railway.*

A boat is in the lock, the gate is closed, and water from the lock can be seen rising just below the gate.

People

Sec. 283. Population.—The population of Ontario in 1921 was 2,900,000. This was larger by six hundred thousand than the population of Quebec, and larger than that of all the Western Provinces combined. But Ontario will not long continue to surpass the Western Provinces, as they are increasing in population much more rapidly than any other part of Canada. More than nine-tenths of the people are concentrated in part of Old Ontario, which comprises less than one-tenth of the area of the province, so that the population is very unevenly distributed. More than half the people of Ontario live in the towns and cities.

The Province of Ontario, from the time when it was first settled by the United Empire Loyalists, has remained British in all its institutions and aspirations. Over seventy-five per cent. of the population are of British origin. There are over 220,000 French people living mostly in the eastern counties, and almost an equal number of Germans in several areas scattered over the province. The people of Ontario are well educated, industrious, steady, alert, and very progressive.

The Great Lakes

Sec. 284. The Great Lakes comprise together the largest body of fresh water in the world. Every part of Old Ontario is subject to their influence, and they have contributed more than anything else to the development of the province.

Lake Superior, the largest, is more like a great inland sea than a lake. Its waters are deep, and since the hard rocks of the Canadian Shield form its northern margin, its coast is high and rugged. During storms, the waves are almost as fierce as those of the ocean, and even more destructive. Lake Superior drains into *Lake Huron* through *St. Mary River*. The Sault rapids caused by the drop of twenty feet from one lake to the other form a barrier to navigation, which is circumvented by two canals (Fig. 124). That on the Canadian side has one of the longest locks in the world. The American canal has three locks side by side, which allow ships to be locked through in opposite directions at the same time. At *Sault Ste Marie* (pop. 21,203), a Canadian city on the St. Mary River, the power generated by the rapids is employed for manufacturing pulp and lumber. Large steel works are also situated here.

The northern coast of Lake Huron, being in the region of the Canadian Shield, is high and rugged like the coast of Lake Superior. The southern part of the lake is surrounded by beautiful agri-

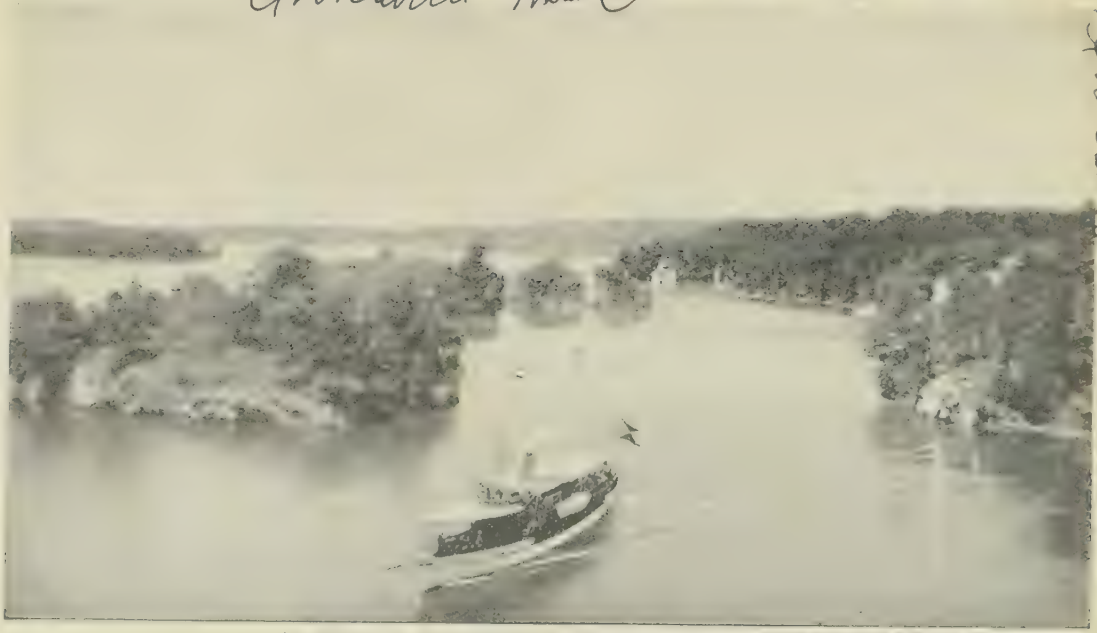


FIG. 125. A BEAUTY SPOT IN THE THOUSAND ISLANDS [*Courtesy of New York Central Railway.*]

Many of the 1700 islands are owned by wealthy people from the cities of Canada and the United States, who build beautiful summer homes on them.

cultural land. *Manitoulin* and several other islands cut off a part of the lake to the north, called the *North Channel*. *Georgian Bay*, a large eastern arm of Lake Huron, is notable for the thousands of islands that fringe its shores. The scenic beauty of a trip through the channels between these islands is unsurpassed in Canada, and thousands of tourists every summer sail through the "thirty thousand islands."

The outlet of Lake Huron is the *St. Clair River*, which expands into *Lake St. Clair*, a body of water some thirty miles long. This lake is so rapidly filling up with sediment that a ship canal has been dredged in order that the largest vessels may pass safely. Lake St. Clair is drained by the *Detroit River*, which flows into Lake Erie.

Lake Erie, the shallowest of all the Great Lakes, is connected with Lake Ontario by the Niagara River. At Niagara Falls the water drops over a precipice 155 feet in height. *Goat Island*, in the middle of the stream, separates it into two cataracts, the American Falls and the larger Horseshoe or Canadian Fall. For seven miles through the narrow gorge below, the water rushes in a series of rapids, finally emerging at Queenston as a broad and peaceful river.

This obstruction to navigation is overcome by the Welland Canal between the two lakes from *Port Colborne* to *Port Dalhousie*. It is twenty-eight miles long and makes a drop of 362 feet by means of twenty-seven locks. The length and draught of ships able to pass through the canal is limited by the size of the locks, which are 270 feet long and fourteen feet deep. A new canal is now being constructed, which will have locks eight hundred feet long and twenty-nine feet deep. When this is completed the largest vessels from the Upper Lakes will be able to carry their cargoes right through to *Kingston* and *Prescott*.

Lake Ontario, the smallest of the five Great Lakes, is much deeper than Lake Erie. Towards the eastern end *Prince Edward Peninsula* projects far into its waters.

Just beyond the point where the St. Lawrence River leaves Lake Ontario it runs through a region of hard Laurentian rocks (part of the Canadian Shield) among which numerous channels have been worn by the swift current. The more resistant parts are left projecting above the water to form a bewildering maze of beautiful, wooded islands, with the waters of the St. Lawrence winding among them (Fig. 125). Though they are called the *Thousand Islands* over seventeen hundred of them have been counted.

From Lake Ontario to Montreal the St. Lawrence falls about 220 feet, thus forming a number of rapids. The most notable of

these, the *Lachine Rapids*, occur just above Montreal (Fig. 123). Though light draught boats traverse all the rapids down stream, canals have been built to avoid the difficulties of such navigation and to permit of travel upstream. Indeed, Canada can boast of having along the St. Lawrence one of the most remarkable systems of canals to be found anywhere in the world.

Sec. 285. Tributaries.—The tributaries flowing into the St. Lawrence and the Great Lakes from Ontario are much larger and more important than those entering from the United States. Since the most elevated land is much nearer to Lakes Superior and Huron than to Hudson Bay, the rivers entering these lakes from the north are short and full of rapids and waterfalls. Although these streams are of little value for navigation, they are very useful for floating the logs and pulp-wood from the north to the mills, where they are made into lumber and pulp. Two of the most important rivers are the *Nipigon* which drains *Lake Nipigon*, situated north of Lake Superior, and the *French River*, which drains *Lake Nipissing* and empties into Lake Huron. The *Grand* and *Thames Rivers*, which are in the western peninsula, rise in the high lands south of Georgian Bay (Map 20 in Atlas) and flow through a beautiful agricultural country to empty into Lake Erie and Lake St. Clair respectively. During the spring, when the snow is melting, they become rushing torrents; but throughout the dry summer the current is so slow and the water so shallow in places that they are not of great value for navigation. The Thames, however, has a deep channel as far as Chatham.

Sec. 286. Trent Valley Canal.—North of Lake Ontario are the beautiful *Kawartha Lakes*, which are connected with each other by rivers containing rapids and waterfalls. They are drained by the *Trent River* into the *Bay of Quinte*, an arm of Lake Ontario north of Prince Edward Peninsula. West of the Kawartha Lakes is *Lake Simcoe*, which drains by the *Severn River* into Georgian Bay. A canal has been cut from Lake Simcoe to the head of the Kawartha Lakes, the connecting rivers have been deepened, and locks built to avoid the rapids and falls. When completed, this whole system, which is called the *Trent Valley Canal*, will allow boats drawing not more than six feet to pass from Georgian Bay to Lake Ontario. The locks at Peterborough and Kirkfield on this canal are different from any other Canadian locks in this respect, that the compartment into which the boat is floated rises or sinks with the ship in it. In a single lock of this kind, such as that at Peterborough, ships are raised or lowered over sixty feet. The locks in the new Welland Canal are to be of the same type.

By means of the *Rideau River*, *Rideau Lakes*, and *Rideau Canal*,

[*Courtesy of Canadian National Railways.*

FIG. 126. CANADIAN NATIONAL RAILWAYS ELEVATOR AT PORT ARTHUR

It is the largest elevator in the world and holds ten million bushels of grain. The grain is brought from the west by train, stored in the elevator and then shipped down the lakes by boat.

it is possible for small boats to pass from Kingston to Ottawa (Fig. 123).

Sec. 287. Lake transportation.—Almost all the cereals exported from the Prairie Provinces are shipped by the Great Lakes, which have thus become one of the most important grain routes in the world. The Canadian Pacific and two lines of the Canadian National Railways carry the grain to *Fort William* and *Port Arthur* (pop. 16,000) where it is stored in the largest elevators in the world (Fig. 126). Throughout the entire season of navigation immense ships carry the grain from these ports to *Midland, Port McNicoll,* and *Depot Harbour*, on Georgian Bay, to *Goderich*, on Lake Huron, and to *Port Colborne* and *Buffalo*, on Lake Erie. From these points it is shipped to Montreal and other seaports to be transported principally to the United Kingdom. It might be asked why, instead of being carried right through to Montreal by railway, the grain should be unloaded from cars into elevators at Fort William and Port Arthur, loaded from the elevators into boats and again at the lower lake ports reloaded into cars. Nothing indicates more clearly the cheapness of water transportation compared with that by railway. In spite of all the extra handling that has to be done, the total cost of transportation to Montreal is less by water than by the all-rail route.

Lumber and pulp, as well as grain, are shipped in large quantities from the upper lakes, and the greater part of the coal supply of the upper lake regions is transported by water from ports on Lake Erie.

Sec. 288. Fishing.—The Great Lakes are the most important fresh-water fishing grounds in the world (Fig. 132). Their large size and the coldness of the water so necessary for the growth of the best food fish account for this. Moreover, the lakes are close to the centre of population. Whitefish, trout, pickerel, pike, and herring are caught in large quantities and are usually shipped in cold storage to the cities and towns of Canada and the United States.

Divisions

Sec. 289. Old Ontario.—From Fig. 127, it will be seen that a spur of the Canadian Shield extends across the River St. Lawrence at the Thousand Islands. That part of the Ontario peninsula to the west of this spur is covered with glacial drift and consequently has a rolling character. A remarkable escarpment begins at Niagara River and runs parallel to Lake Ontario as far as Hamilton, where it is called "the mountain." Then it turns north and runs past Milton, Orangeville, and Collingwood where it is called

the Blue Mountains, finally passing under Lake Huron at the end of Bruce Peninsula. The plain to the east of this escarpment is several hundred feet lower than the plain to the west. The highest land in this whole region is to the south of Georgian Bay where the Thames and Grand Rivers rise. As glacial drift usually makes good soil, the leading industry is agriculture, which will be described in Sec. 293.

That part of Old Ontario to the east and north of the district just described is rougher and more rocky, many parts being unfit

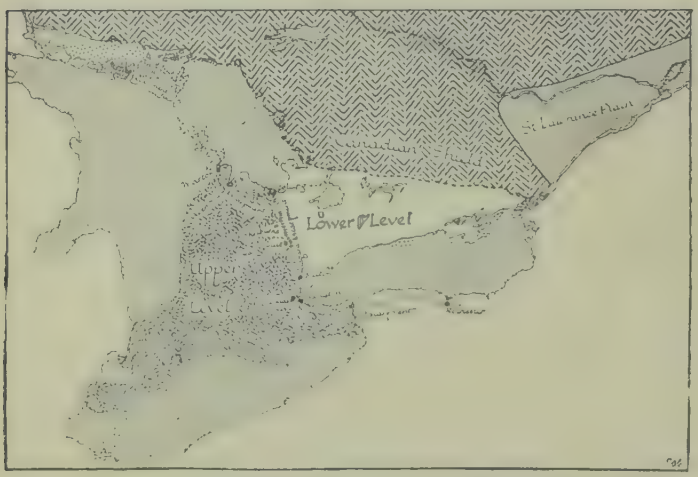


FIG. 127. PHYSICAL DIVISIONS OF OLD ONTARIO, SHOWING NIAGARA ESCARPMENT AND THE TWO LEVELS OF ONTARIO

The positions of the important towns and cities near the escarpment are shown.

for agriculture; in fact it closely resembles the other part of the Canadian Shield to the north. In the angle between the St. Lawrence and Ottawa Rivers, however, there is excellent farming land.

Sec. 290. New Ontario.—This region, which has been already described in Secs. 203 to 208, is the centre of the mining and lumbering industries of Ontario. In the less settled part of it there is excellent hunting and trapping (Fig. 128). As it is now crossed by three transcontinental railways from east to west, and by two railways from north to south, its industrial development will be more rapid.

Sec. 291. The Clay Belt. -Beyond the high land is a remarkable tract of level country, called the *clay belt* (Fig. 93), the surface

[*Courtesy of Massey-Harris Company.*

FIG. 128. INDIAN CALLING MOOSE ON THE FRENCH RIVER, ONTARIO
The moose answers and comes toward the call, when the Indian shoots it.

layers of which are largely made of sediment deposited in an ancient lake; consequently, the belt is as fertile as any district in Old Ontario. This region, which has an equable and temperate climate, and an abundance of wood and water, is three-quarters as large as Old Ontario. It stretches from *Lake Abitibi* on the east to a point north of Lake Nipigon on the west and is probably able to support a population of several million people. Now that a trans-continental line of the Canadian National Railways passes through the heart of the clay belt it is expected that settlers will rapidly take up the land (Fig. 129).

Sec. 292. Patricia.—The most northern part of Ontario, which was added to it in 1912, is a wilderness of forests veined with rivers and dotted with lakes. It is named *Patricia* after Princess Patricia of Connaught, daughter of a former Governor-General. Undoubtedly, this region is rich in minerals and in timber, but although there are tracts of arable land, it is uncertain how suitable the climate will prove for agriculture.

Industries

Sec. 293. Agriculture.—Throughout the whole of Southern Ontario the chief industry is agriculture, which is carried on scientifically and skilfully. The agricultural products of Ontario are more valuable than those of Quebec and almost rival those of the three Prairie Provinces combined. Ontario produces more peas, rye, corn, sheep, cattle, swine, poultry, cheese, eggs, and apples than any other province (Fig. 130). Since the Prairie Provinces have begun raising wheat on a large scale, Ontario has been unable to compete with them in this respect, and has gone extensively into mixed farming, which requires more skill and gives a more certain reward. With the rapid increase of population the raising of perishable fruits is developing in importance every year. Apples, pears, plums, and cherries are grown in all parts of Old Ontario in the vicinity of the Great Lakes. Peaches and grapes, which thrive best in a mild climate, are most extensively grown in the counties bordering on the north shore of Lake Erie (Fig. 132).

Sec. 294. Mining. The minerals of the Canadian Shield have been already described (Secs. 219 and 226). Salt is extensively mined in the counties of Essex, Lambton, and Huron, the chief mines being at *Windsor* and *Sarnia* (Fig. 132). The salt is obtained by means of borings, down which water is run to the bed, and after becoming saturated with salt is pumped up and evaporated. In the vicinity of the town of *Petrolea*, in Lambton County, considerable quantities of petroleum are pumped from oil-wells.

[*Courtesy of Canadian National Railways.*

FIG. 129. THE KIND OF CROPS GROWN IN THE CLAY BELT
A crop of oats in Northern Ontario.

Natural gas, which is found chiefly in the counties bordering on Lake Erie, is used extensively as fuel in houses and factories throughout the region in which it occurs. Limestone for making lime and sandstone for building purposes are extensively quarried in widely distributed parts of Ontario.

Sec. 295. Manufacturing.—The value of the goods manufactured annually in Ontario is equal to that of those manufactured in the remaining provinces of Canada. The cheap distribution of hydro-electrical power by the provincial government is bound to make Ontario one of the greatest manufacturing districts on the continent (Fig. 131). Almost everything from a needle to a locomotive is now made in some part of the province, every town and city having some manufacturing establishment, and many of them having a considerable number. The nature of the goods manufactured is largely determined by the fact that they are made very largely for the home trade. Consequently, they consist of commodities largely used in an agricultural region, and especially those that can be made from raw materials produced locally (Fig. 132). Agricultural implements of various kinds are manufactured in Toronto, Hamilton, St. Catherines, Brantford, Woodstock, Chatham, and Smiths Falls. Cottons are manufactured in Cornwall and Hamilton; pig iron in Sault Ste Marie, Hamilton, Port Arthur, Deseronto, and Midland. Woollens, wood-pulp, electrical appliances, fertilizers, calcium carbide, and chemicals are among some of the other important manufactured goods.

Cities and Towns

Sec. 296. Toronto is the second city in the Dominion of Canada. Its population in 1921 was estimated to be 519,000. Although it has not such a favourable situation for commerce as Montreal, being neither an ocean port, nor on the direct railway line from east to west, it is the gateway to South-Western Ontario, the wealthiest and most densely populated part of Canada. Consequently it is the chief distributing centre for the district and is the focus of all the railways that serve this thriving agricultural and manufacturing region. Moreover, it is the centre from which the products of this part of the province are shipped to the west. It is also a lake port and has a commodious harbour, well protected by islands. Its manufactures are numerous, including metal goods of all kinds, bicycles, cotton goods, furniture, and smoked meats. Being the capital city of the wealthiest province of Canada it has some fine buildings, including the Provincial Legislative Buildings, the Government House, Osgoode Hall (the chief law court) and the

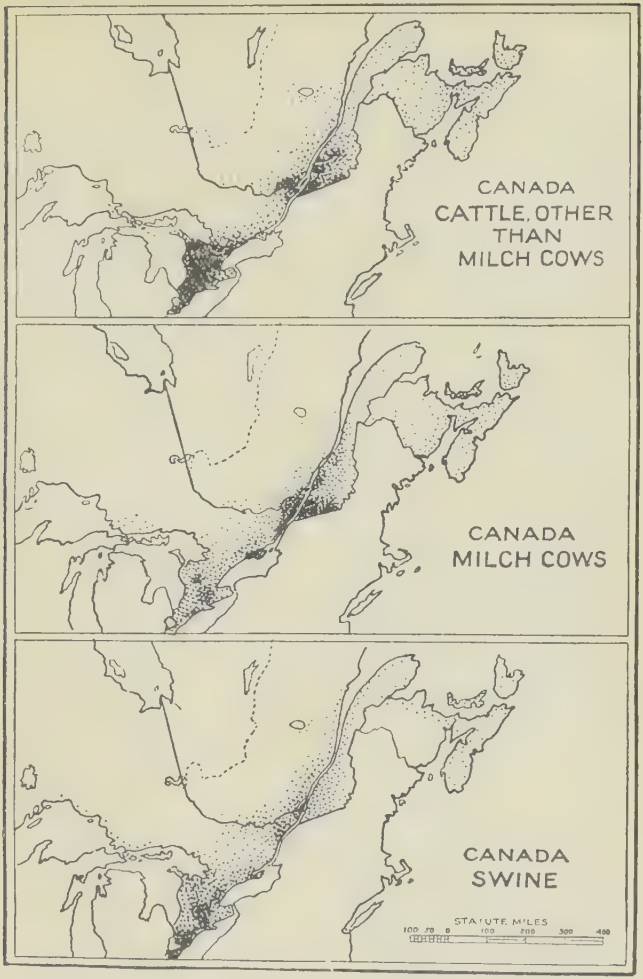


FIG. 130. DISTRIBUTION OF CATTLE AND SWINE IN EASTERN CANADA

In which part of Ontario are most beef cattle produced? In which are most butter and cheese manufactured?

[From the Times Trade Supplement.

FIG. 131. DISTRIBUTION OF HYDRO-ELECTRICAL POWER IN ONTARIO

General Hospital. Finally it is an important educational centre. The University of Toronto with its affiliated colleges, Victoria, Trinity, and St. Michael's, is the crown of the educational system of the province. Outside of the affiliation stands McMaster University, a Baptist institution.

Sec. 297. Ottawa (pop. 107,000), the capital of the Dominion of Canada, is situated on the high, southern bank of the Ottawa River. As it is a great railway centre, is connected with both Kingston and Montreal by navigable water, and has a large amount of water-power easily available, it has rapidly become an important industrial city. Because it is situated at the confluence of the Gatineau, Ottawa, and Rideau Rivers, whose valleys all lead back to forests, it has long been a notable lumbering centre. The city is perched on a cluster of hills, crowned with the magnificent pile of the Parliament Buildings and made more picturesque by the mists from the Chaudiere Falls.

Sec. 298. Hamilton (pop. 114,000) is an important city, which ranks next after Toronto and Montreal in the value of its manufactured goods. Its situation at the extreme western end of Lake Ontario and its numerous railways give it special facilities for transportation. Besides, its proximity to the electrical power generated at Niagara Falls and to the natural gas fields to the west and south gives it great advantages for developing industrial institutions. A good many American manufacturing corporations have built Canadian branches in Hamilton.

Sec. 299. Smaller cities.—The other cities and towns of Ontario may be divided into two groups, the commercial and industrial. The commercial cities and towns are located on the Great Lakes, usually at the terminals of important railways. Most of them have also manufacturing establishments. On Georgian Bay are *Owen Sound* and *Collingwood*. *Sarnia* (pop. 15,000), on the River St. Clair, is the Canadian terminus of the main line of what was formerly the Grand Trunk Railway, now a branch of the Canadian National, which crosses the St. Clair River at this point by means of a tunnel. *Windsor* (pop. 38,000), opposite the city of Detroit, has important manufactures, and is the Canadian terminus of branches of the Canadian Pacific, the Canadian National, and the Michigan Central Railways. The adjoining towns, *Walkerville* (pop. 7,000), *Ford* (pop. 6,000), and *Sandwich* (pop. 4,000), are also busy manufacturing places. Before the locks on the St. Lawrence canal were enlarged, lake boats transferred their cargoes to shallow-draught boats at *Kingston* (pop. 23,000), from which city the goods were shipped to Montreal. Now large boats go right through and Kingston is no longer so important a shipping centre, but the enlarged Welland Canal may

FIG. 132. ECONOMIC MAP OF ONTARIO

more than restore to this city its former commercial importance. Sault Ste Marie (pop. 21,000) is an important port and industrial city.

The industrial cities and towns manufacture goods chiefly for the home market. They are therefore located chiefly in the thickly settled south-western part of the province, usually on important railway lines. Almost all of them manufacture several classes of goods. *London* (pop. 61,000) in Middlesex, *Chatham* (pop. 12,000) in Kent, *Woodstock* (pop. 10,000) in Oxford, *Stratford* (pop. 16,000) in Perth, *Guelph* (pop. 18,000) in Wellington, *Kitchener* (pop. 22,000) and *Galt* (pop. 13,000) in Waterloo, *Brantford* (pop. 29,000) in Brant, *Niagara Falls* (pop. 15,000) and *Welland* (pop. 9,000) in Welland, *Oshawa* (pop. 11,000) in Ontario, and *St. Catherines* (pop. 20,000) in Lincoln are all thriving manufacturing cities which produce, among other commodities, agricultural implements, furniture, musical instruments, and metal goods. *St. Thomas* (pop. 16,000) is an important railway centre in Elgin County. The manufacturing towns of Eastern Ontario, where the population is not so dense, are less numerous. Electrical goods, woollens, carpets, and cordage are some of the commodities manufactured at *Peterborough* (pop. 21,000), which uses electrical power developed on the Trent Valley Canal. *Cornwall* (pop. 7,000), which obtains power from the St. Lawrence rapids, has large cotton mills. The city of *Belleville* (pop. 12,000) and the town of *Brockville* (pop. 9,000) have a large export trade in cheese as well as important manufacturing establishments.

Sec. 300. Villages.—There are numerous villages scattered over the province, many of which either grow slowly or have diminished in population and importance. In fact the majority are of much less importance than they were forty years ago. Formerly, when roads were bad and railways few, farmers went to these small villages to do their trading, to have their wheat ground, or to have their logs cut into lumber. But now that roads have improved, and railways have become more accessible, they prefer to trade in the towns and cities. Moreover, the little wheat they grow is either sold to dealers at the nearest elevator or fed to stock, because they prefer flour made from a better quality of wheat. Consequently, most of the small flour mills in the villages have disappeared, and since the timber is largely exhausted, the saw-mill is also closed. The villages have felt the loss of the flour mill, the grist mill, and the farmer's trade and have greatly declined.

CHAPTER XXI

THE PRAIRIE PROVINCES

Project

Sec. 301. To study the production of wheat in Western Canada.—Examine the surface of the Prairie Provinces as shown in Map 22 in Atlas. Which part is lowest? Which is highest? What is the general direction of the slope? Generally speaking, is the surface rough or flat? What part has the greatest rainfall? (Map 16 in Atlas.) What part has the least rainfall? How does the rainfall of the Prairie Provinces compare with that of Ontario? At what season have they the heaviest rainfall? (Sec. 215.) Are the rainfall seasons most favourable for the growth of wheat? Read in Sec. 131 the conditions favourable for the growth of wheat. Which of these favourable conditions are found in the Prairie Provinces? In what parts of the Prairie Provinces is wheat grown in the largest quantities? (Fig. 98.) Why is so little wheat grown in south-western Alberta? Where are railways most numerous? What is the relation between the position of the wheat areas and that of the railways? What is the relation of the position of the [illegible] and that of the wheat areas? (Fig. 133.) Explain the [illegible] ships. What building material is sure to be expensive [illegible] regions? Hence suggest a reason why farmers store [illegible] elevators rather than in granaries. Why are buildings a ne[illegible] for the raising of cattle in the Prairie Provinces? Which kind of farming requires more capital, grain-raising or mixed farming? Which is likely to be carried on most extensively in a newly-opened district? Describe the chief regions in which oats are grown (Fig. 98).

Boundaries and Extent

Sec. 302.—The eastern boundary of the Prairie Provinces is Ontario to the south and Hudson Bay to the north; the northern limits are formed by the districts of Mackenzie and Keewatin; on the west is British Columbia, part of the boundary being formed by the crest of the Rocky Mountains; and on the south are the United States.

The three provinces of the prairie belt, Manitoba, Saskatchewan,

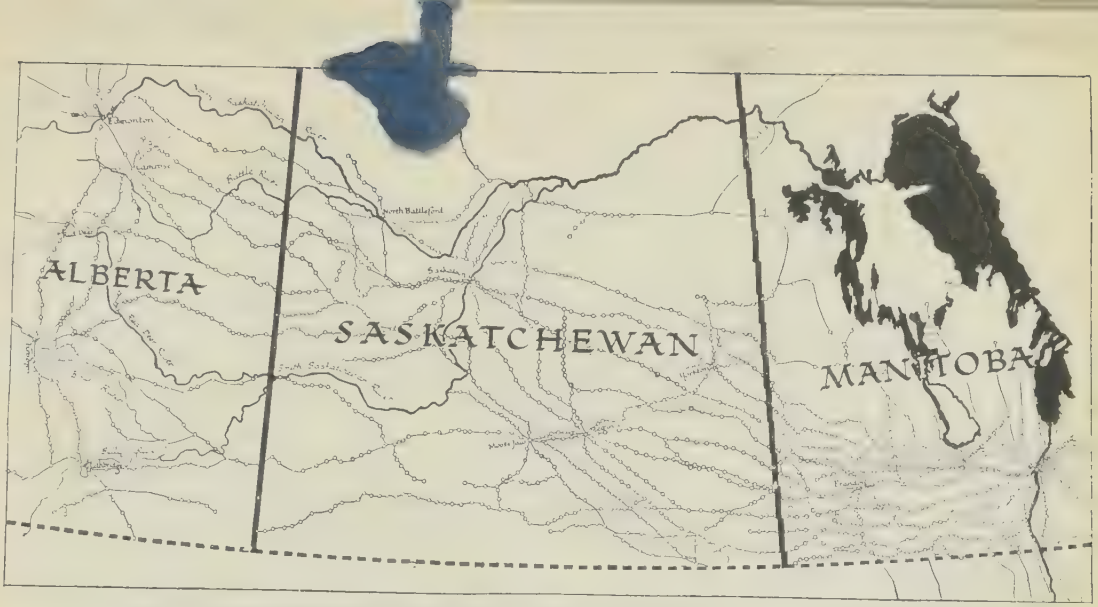


FIG. 133. MAP SHOWING THE POSITIONS OF THE ELEVATORS IN THE PRAIRIE PROVINCES

Each circle represents one or a group of elevators. The railway lines are marked. What is the relation of the elevators to the railways? From the relation of the elevators to the rivers would you infer the latter were used extensively for transport? Compare this map with Fig. 98 and state the relation between the position of the elevators and wheat fields.

FIG. 134. NATURAL DIVISIONS OF THE PRAIRIE PROVINCES

The three levels are united internally; the escarpments between the levels are indicated. Compare these escarpments and the different levels with those in Old Ontario (Fig. 127).

[*Courtesy of Canadian National Railways.*

FIG. 135. COULÉE AT FORT QUAPPELLE, SASKATCHEWAN

Notice the low flat in which the village is situated with high bluffs on each side. The small meandering river is seen to the right. Beyond the coulée notice the flat, level, treeless prairie.

[*Courtesy of Canadian Pacific Railway.*

FIG. 136. CUTTING GRAIN ON A LARGE FARM IN SASKATCHEWAN

How many binders are at work? How many horses are on each binder? Notice how level and treeless the prairie is.

and Alberta, are about equal in extent. Although each is only a little more than half as large as Ontario, each is larger than either France or Germany and more than twice as large as the British Isles. The length of each province from north to south is 750 miles, more than twice the distance from Toronto to Montreal.

Surface and Drainage

Sec. 303. Surface.—The Prairie Provinces, though comparatively flat, being part of the great central plain, increase in altitude from east to west. This increase, however, is not steady, but is especially marked in two escarpments, which are shown in Fig. 134. These two escarpments run from the south-east to north-west; the more easterly enters Manitoba at about the middle of the southern boundary, and runs as a series of hills parallel with Lakes Manitoba and Winnipegosis. The more westerly escarpment, called the *Missouri Coteau*, enters Saskatchewan from the south about fifty miles west of Manitoba, and runs diagonally, passing west of *Moosejaw* and *Saskatoon*. This, like the more easterly escarpment, consists of a series of hills. These two escarpments separate the region into three divisions called the *three prairie levels*, the lowest of which is to the east, while the highest borders the foothills of the Rockies. The lowest level, which is largely occupied by the lakes of Manitoba, is one of the flattest and most fertile regions in the world. Both these characteristics are due to the fact that it is the bed of an old lake, and that the surface layers are composed of sediment. The second and third prairie levels are more rolling than the first, and since they are underlaid by soft rocks, the rivers have eroded deep valleys such as are not usually met with in Eastern Canada. These valleys, called *coulées* (Fig. 135), cannot be seen at a distance as one looks over the level prairie, and it is quite a surprise to come suddenly upon such a valley, two or three miles wide and several hundred feet deep, with a small stream winding its way along the bottom.

Sec. 304. Drainage.—The rivers have already been described (Sec. 212). *Winnipeg*, *Manitoba*, *Winnipegosis*, and many smaller lakes are but the remnants of a much greater body of water, called *Lake Agassiz*, which formerly covered a large part of Manitoba and extended south into the United States. These lakes are very irregular in shape, are comparatively shallow, and are chiefly valuable for their abundant supplies of whitefish, pickerel, and pike. Lake Winnipeg is navigable throughout its course, and the only serious obstacle to navigation from Winnipeg to Edmonton through the Red River, Lake Winnipeg, and the Saskatchewan River is *Grand Rapids* at the mouth of the latter river.

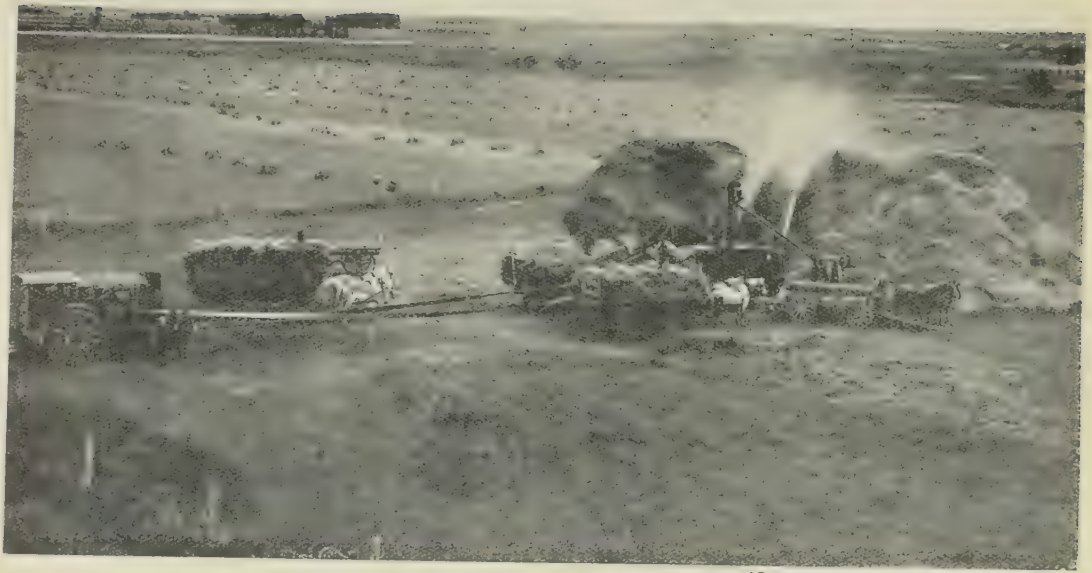
Agriculture

Sec. 305. Wheat. — Many factors have combined to make the Prairie Provinces one of the greatest wheat-producing regions in the world. In the first place the soil is mainly a fertile clay loam, which is especially suited to the growth of wheat, while the flatness of the region and the absence of forests make the land extremely easy to break up and cultivate. In the second place the climate is of such a character as to produce not only an abundant crop but the best quality of wheat grown anywhere in the world. Though the rainfall is light, it occurs most copiously in the spring and early summer, just when the crop requires it to make each plant send up many vigorous branches from the main stem; and in late summer the dry weather and bright sunshine produce a large, hard, wheat grain. Although the climate is favourable in most respects for the growth of wheat, there are two ugly factors that have been the cause of great damage to crops. Hailstorms occasionally come in June or early July and cut down the tender plants. But much worse than these are the early autumn frosts, one of which may do millions of dollars' worth of damage in a single night (Figs. 136 and 137).

When the wheat is harvested it is not stored in granaries as in the eastern provinces, but is taken to elevators, which are situated at almost every railway station. From these elevators it is shipped eastward as rapidly as cars can be obtained for the purpose.

Sec. 306. Other crops.—The Prairie Provinces raise even greater quantities of oats than of wheat. The total value of the wheat, however, is much greater than that of the oats. Barley is also produced in much larger quantities than in any of the other provinces. The growth of flax was begun in all the Prairie Provinces about 1904, and has developed so rapidly that to-day Canada is surpassed in the amount of flax-seed produced only by Argentina, India, and the United States (Fig. 73).

Sec. 307. Stock-raising.—The raising of horses, cattle, and swine is just beginning in the Prairie Provinces (Fig. 138). Since the wild grass of the prairies makes excellent fodder, it might have been thought that such a profitable branch of farming would develop early. But there are several reasons why grain-growing has preceded stock-raising. As land is cheap and abundant and the early settlers had little capital, they began with the kind of farming that required little outlay and gave quick returns. To raise wheat it is necessary to have only a team of horses or a yoke of oxen, and a few agricultural implements. In order to raise stock in such a severe climate, the farmer requires large, warm buildings, and in the treeless prairies timber is very dear.



[*Courtesy of Canadian National Railways*

FIG. 137. THRESHING AT PORTAGE PLAINS, MANITOBA

Is the grain stacked before it is threshed? What is being done with the grain? Will trees grow on the prairies?

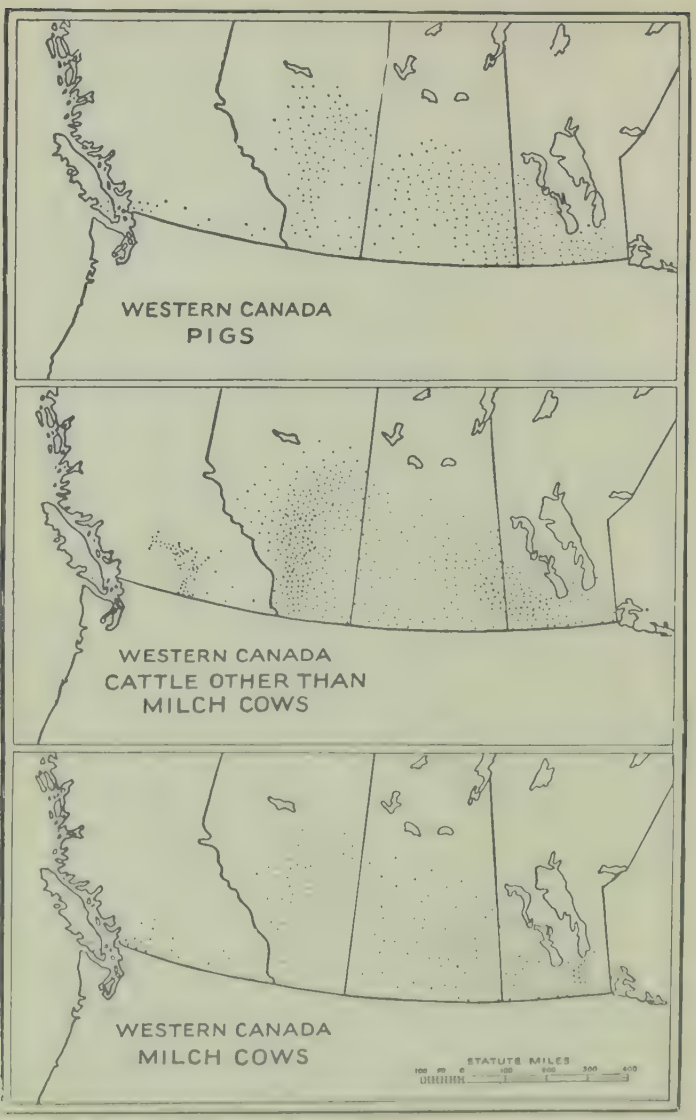


FIG. 138. DISTRIBUTION OF STOCK IN WESTERN CANADA

[*Courtesy of Grand Trunk Railway.*

FIG. 139. CATTLE RANCH AT PUNICHI, SASKATCHEWAN

Notice the excellent pasturage, the level prairie, and the low shrubby trees around the water.

[*Courtesy of Canadian National Railways.*

FIG. 140. SHEEP RANCH, WAINWRIGHT DISTRICT, ALBERTA

Notice the poor pasturage compared with that of the preceding picture. Notice also that the country is slightly rolling.

Moreover, as it takes some years to rear a good drove of cattle, the returns from stock-raising at first are much less than the outlay. However, stock-raising and mixed farming are rapidly developing with great benefit both to the land and the farmer (Fig. 138). It is beginning to be recognised that the fertility of the land is not inexhaustible, and that if a crop is taken off each year, and no nourishment returned to the land in the form of manure, productivity soon diminishes. By raising stock it is possible to keep up, if not to increase, the soil's fertility. Mixed farming has also direct advantages to the farmer. The man who raises only grain crops may be ruined by a single hailstorm or an early autumn frost, for he depends entirely on his wheat, but the man who carries on mixed farming has many sources of profit, and is not so much dependent on the weather. Consequently, a rapid development of mixed farming may be looked for in Manitoba and Saskatchewan.

Sec. 308. Southern Alberta. — In two respects the climate of Southern Alberta is markedly different from that of the rest of the Prairie Provinces. The winters are very much milder, and the rainfall is so light that parts of the region are semi-arid. Though many districts are not suitable for raising crops, they make excellent cattle ranges (Fig. 139). In such regions, since there is little or no snowfall, the cattle can graze on the dead prairie grass throughout the winter. In the driest part sheep replace cattle (Fig. 140).

Sec. 309. Irrigation.—Recently a portion of the semi-arid parts of Southern Alberta has been brought under cultivation by means of irrigation (Fig. 141), which has been developed by the Canadian Pacific Railway and other companies, and already over 1,500,000 acres have been made productive. Water is conducted from the reservoirs through canals and distributed to the farms. By this means land that was formerly considered only suitable for cattle ranches has proved to be as fertile as the rest of the prairie and is rapidly becoming dotted with splendid farm-houses.

Potatoes are now grown extensively on the irrigated lands, and some of the non-irrigated land of this region has been found quite capable of producing crops; alfalfa, a kind of clover, and other products now cover large areas of the semi-arid country.

Mining

Sec. 310. Coal.—In a flat country covered by a fertile soil minerals are not usually found. But large areas of Southern Manitoba, Southern Saskatchewan, and the greater part of Alberta are underlaid by coal. So accessible is this mineral that at many points it

comes nearly or quite to the surface. Although the supply is almost inexhaustible, the quality of much of it is inferior. In fact, the only coal found in Manitoba and Saskatchewan is *lignite*, a very soft, impure variety. As the seams approach the Rocky Mountains, where formerly they were subjected to great heat and strain when the strata were being folded, the quality of the coal improves, and the greatest and most valuable coal mines are near these mountains. The *Crow's Nest coal-field*, one of the most important, is in the Rocky Mountains of Southern Alberta. *Lethbridge* (pop. 11,000) and *Edmonton* are large producers of soft coal, and on the main line of the Canadian Pacific Railway, just east of Banff, hard coal, or anthracite, is mined. In Alberta near Red Deer is found a remarkable sandstone formation from which have been obtained the fossil remains of some giant reptiles (Fig. 142). In recent years enormous deposits of copper and rich veins of gold have been found in Northern Manitoba and are likely to lead to great development (Fig. 144).

Sec. 311. Tar sands.—Along the Athabaska River in Northern Alberta is found a tar-like substance mixed with sand (Fig. 144). It is probable that great quantities of petroleum welled up in earlier ages, and that the more liquid parts evaporated and left the sand impregnated with the solid parts of the oil. Since the strata of tar sands are over two hundred feet thick and cover one thousand square miles, the quantity is almost inexhaustible. Though little use has been made of this mineral up to the present, it is likely that it can be utilized for paving roads, for roofing, for insulation, and perhaps for fuel. Up to the present the chief interest in the tar sands has been due to the evidence they give of the region being underlaid by petroleum.

Fishing

Sec. 312.—The numerous lakes in Manitoba and in the northern parts of Saskatchewan and Alberta are well stocked with whitefish, pickerel, and pike, which have become an important article of commerce. The fishing is carried on by the farmers, especially during the winter, when they catch the fish through holes cut in the ice.

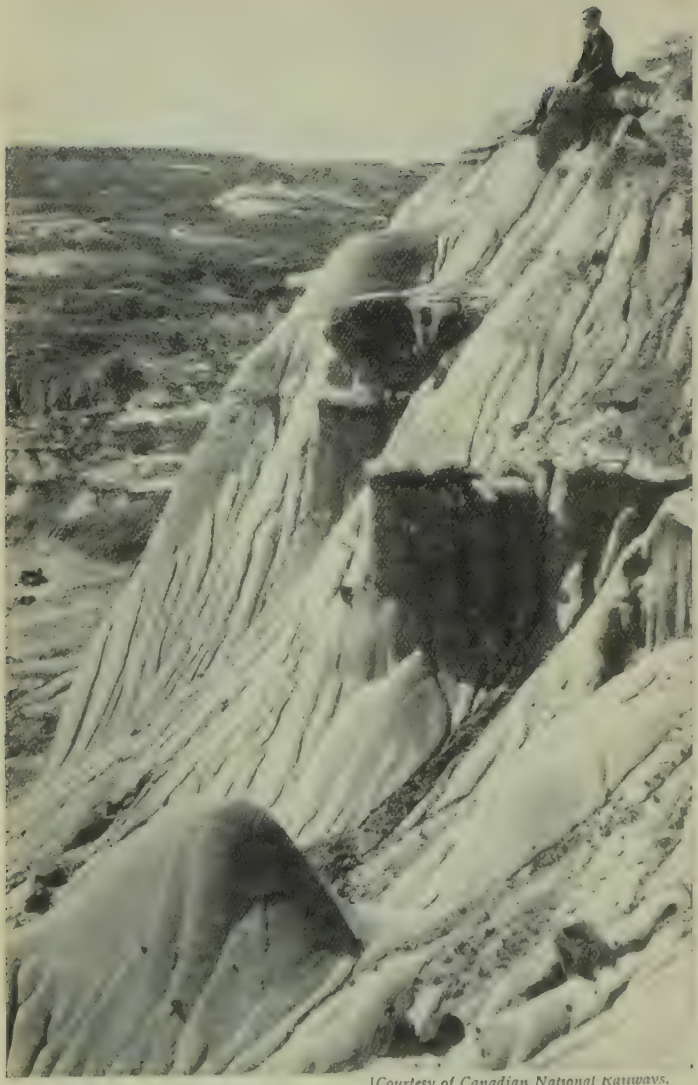
Manufacturing

Sec. 313.—Up to the present little manufacturing has been done in the Prairie Provinces. Since there is little water-power except at the extreme east and west, and since coal is expensive, the lack

[Courtesy of F. C. C. Lynch, Superintendent, Natural Resources Intelligence Branch, Department of the Interior, Ottawa

FIG. 141. IRRIGATING A FIELD OF POTATOES NEAR DUCHESS, ALBERTA

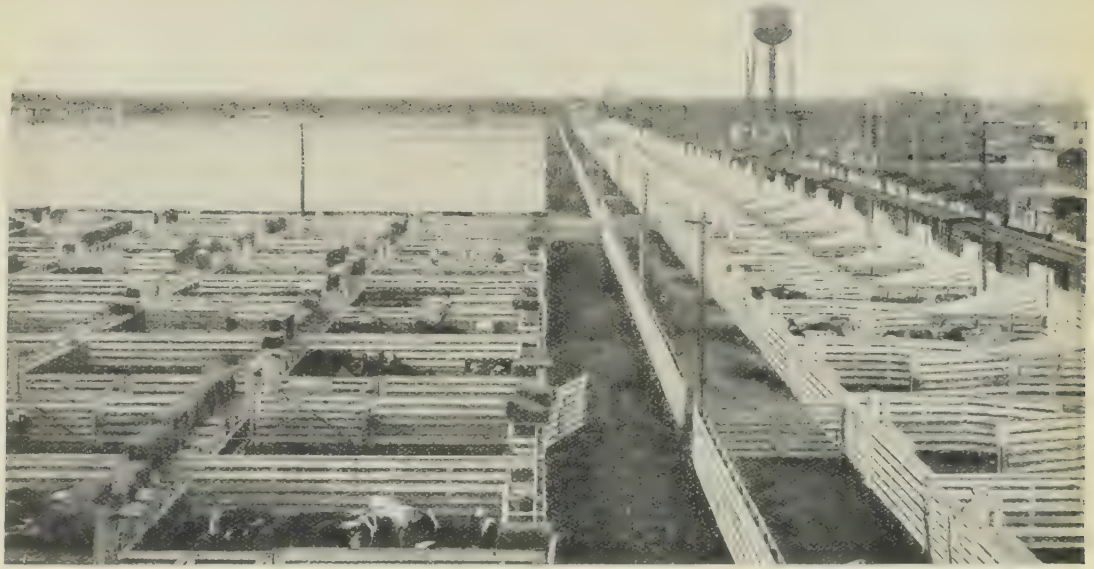
Why must the land, in order to be irrigated, be level?



[*Courtesy of Canadian National Railways.*

FIG. 142. THE SANDSTONE FORMATION FROM WHICH THE REMAINS OF GIANT REPTILES HAVE BEEN TAKEN

From Red Deer Valley, Alberta.



[*Courtesy of Canadian National Railways.*

FIG. 143. PART OF UNION STOCK YARDS, WINNIPEG, MANITOBA

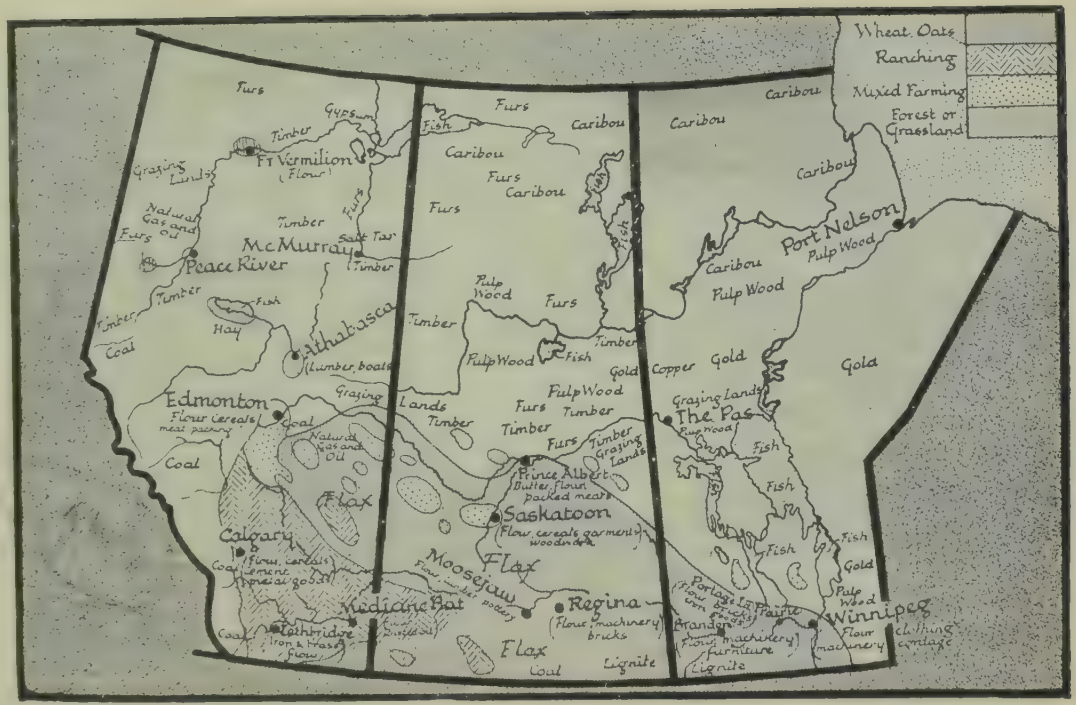


FIG. 144. ECONOMIC MAP OF THE CANADIAN PRAIRIE PROVINCES

of manufacturing establishments is not surprising. Moreover, labour has always been scarce in the Prairie Provinces, and owing to the sparse population, the home market has been a very small one. But now that population is rapidly increasing, and that coal mining and improved transportation are making fuel more accessible, manufacturing is beginning to make headway, and already there are numerous factories in the towns and cities. Winnipeg alone has over five hundred factories employing twenty thousand hands (Fig. 144).

Cities and Towns

Sec. 314.—The cities and towns are almost entirely dependent on the farming communities. They are the centres of distribution of manufactured and other articles, and are also the points to which the farm products are collected for shipment to the East. Consequently a town springs up at any point from which a number of railways ramify, especially if it is in the centre of a good agricultural region. *Calgary* and *Edmonton* in Alberta; *Regina*, *Saskatoon*, and *Moosejaw* (pop. 19,000) in Saskatchewan; and *Winnipeg* and *Brandon* in Manitoba owe their importance largely to these causes.

Winnipeg (pop. 178,000), situated on the Red River at the point where it receives the water of the Assiniboine, is one of the leading cities of Canada. Placed in the narrow gap between Lake Winnipeg and the Lake of the Woods, it stands at the gateway of the Canadian West. Every transcontinental railway, no matter how far north its line runs through the Prairie Provinces, is forced down to Winnipeg by the lakes of Manitoba, which bar its way. Almost all the manufactured products of Eastern Canada and Europe come first to Winnipeg, from which city they are distributed farther west. As all the grain and cattle (Fig. 143) shipped from the Prairie Provinces must pass through Winnipeg, it is the greatest grain market in the world. Its growth has been as rapid as that of the provinces which it serves, and it is destined to be one of the greatest cities, if not the greatest, in Canada. The fine trees that shade the streets of *Brandon* (pop. 15,000), situated on the flattest part of the prairie, prove conclusively the error of the prevalent belief that the climate of the region is unsuitable for the growth of trees. *Regina* (pop. 34,000), the capital of Saskatchewan (Fig. 145), and *Saskatoon* (pop. 26,000), which is the seat of the provincial university and is also a great railway centre, are the chief cities of Saskatchewan. *Edmonton* (pop. 29,000), the capital of Alberta, contains the provincial university, but *Calgary* (pop. 63,000), farther south, is the largest city in the province.

[*Courtesy of Canadian National Railways.*

FIG. 145. PARLIAMENT BUILDINGS, REGINA, SASKATCHEWAN

Transportation

Sec. 315. The Prairie Provinces (Fig. 133) are well supplied with railways. This is partly due to the fact that, on account of the great flatness of the country, railways can be cheaply constructed. For the same reason roads are easily made; in fact it is quite possible to drive almost anywhere over the prairie. River transportation has not been greatly used up to the present, because, owing to the small rainfall in late summer, the rivers become so low that only flat-bottomed boats can be employed. The Saskatchewan, the chief river, has rapids along its course and also many shifting sandbars.

The People

Sec. 316. The population of the Prairie Provinces and British Columbia is composed of many nationalities. Large numbers of people from the eastern provinces of Canada, from Britain, the United States, the Austro-Hungarian countries, Russia, and Scandinavia have been attracted to these provinces by cheap land and the splendid opportunities offered. The great majority of the people, however, are British-born, and of the foreigners, the immigrants from the United States are most numerous. There are also many Galicians from Czecho-Slovakia, and Ruthenians and Doukhobors from Russia and Ukraine.

CHAPTER XXII

BRITISH COLUMBIA

Sec. 317.—Map-study to determine—

(1) *The position of the province.*—In what part of Canada is British Columbia? What do we call the three provinces bordering the Atlantic coast of Canada? Could you apply the same term to British Columbia? Why may British Columbia be called the Sunset Province?

(2) *The particular boundaries.*—Trace the 49th Parallel to the sea. Note Boundary Bay and Point Roberts. What strait does the boundary line follow down the Gulf of Georgia? What States of the United States touch British Columbia on its southern border? How is the boundary arranged between British Columbia and Alberta? What part is a natural boundary? What part an artificial line? Why is the 60th Parallel not followed on to the sea? Would it be any advantage to British Columbia to be possessed of this Alaskan tongue? Find the names of ten islands lying off the coast.

Sec. 318.—British Columbia is in many respects the most remarkable of all the Canadian provinces. Its surface alternating between magnificent snow-capped mountains and deep valleys; its climate comprising in different regions all the climates to be found in the other provinces, and some quite unknown elsewhere in Canada; its long, narrow lakes connected by rivers that make the most sudden turns and pass through the darkest canyons; its diversity of vegetation; and its varied coast-line, all combine to make it by far the most interesting of the provinces.

Sec. 319. Size.—British Columbia (372,630 sq. miles) is surpassed in size by only two other provinces, namely, Quebec and Ontario. It is almost one and a half times as large as each of the Prairie Provinces, and seven times as large as England. It is more than 750 miles long, and has an average width of about 400 miles.

Sec. 320. Surface features.—With the exception of the north-eastern portion, the whole province is occupied by the Cordillera of Canada. The most striking features of these highlands are two ranges of mountains, the Rockies on the east, the Coast Range on the west, and a great central plateau lying between (Map 23 in Atlas). Another remarkable feature, just west of the Rockies, is a valley called the Rocky Mountain Trench, which can be traced for over seven hundred miles. Along this trench flow, for part of their courses, the Kootenay, Columbia and Fraser Rivers, two important tributaries of the Peace River, and two tributaries of the Liard River (see Fig. 89). The central plateau has many

ranges of mountains crossing it in different directions. Just west of the southern part of the Rocky Mountain Trench is the Selkirk Range, which is notable for its numerous glaciers and wonderful

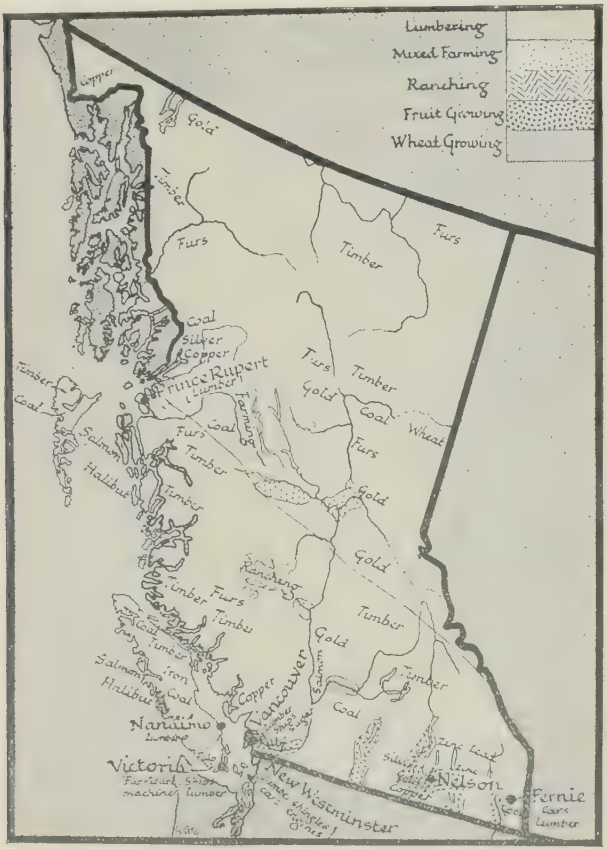


FIG. 146. ECONOMIC MAP OF BRITISH COLUMBIA

scenery. Farther north lie the Cariboo and Cassiar Ranges. All the ranges diminish in height toward the northern part of the province, while the general level of the interior plateau increases in altitude. West of the Coast Mountains is a parallel range of

partially submerged mountains which appear in Vancouver and Queen Charlotte Islands.

Sec. 321. The coast.—British Columbia has a most wonderful coast-line, seven thousand miles long. If the coast-line of the islands be added to this, it is fifteen thousand miles long. The indentations are of an unusual type. All are long, narrow inlets, sometimes called channels or even canals. They wind their way far into the heart of the Coast Range mountains, and frequently divide into two or three arms. These fiord-like valleys have several peculiar features; the water in them is much deeper than in the sea just beyond their mouths; the encircling snow-topped mountains throw their buttresses steeply down into the deeps below, leaving in many places no strand at all; into the heads of these inlets come foaming mountain torrents from the higher levels beyond. They are really deep troughs that have been scooped out by the glaciers which once occupied these mountains areas. Just beyond the mouths of the inlets lies the island fringe. Deep channels separate the islands from the mainland and from one another. In fact, so completely are the coastal waters occupied by these islands, that it is possible for large steamships to sail for almost eight hundred miles along the coast, through narrow protected channels, without once feeling the full force of the Pacific Ocean. Such a coast abounds in excellent harbours of great value to the lumbering, fishing and mining industries.

Sec. 322. Drainage.—Just as the surface features of British Columbia differ from those of other parts of Canada, so do the rivers and lakes. Because the Cordillera of Canada has a number of high mountain ranges running parallel to each other, the rivers are compelled to run along narrow valleys for considerable distances. Then, turning sharply on their courses, they encircle some giant range, reverse their original line of flow, only to plunge through deeply cut canyons to the sea.

In this connection, on a large map trace the main drainage divide of the province from the 49th Parallel, along the crest of the Rockies to a point beyond the Yellowhead Pass; thence in a north-westerly direction through to the 60th Parallel, and the head-waters of the Yukon. The secondary divide which separates the valley of the Skeena from the Fraser may then be drawn. Extend this line to the coast. We now have the province divided into three well-defined drainage areas: (1) the southern drainage basin, (2) the slope to the east (or Mackenzie system), (3) the slope to the west.

Let us examine these in particular:—

(1) The southern drainage basin. This includes the Fraser River system. The main river is 750 miles in length, and the area drained comprises 90,000 square miles. It is by far the largest,

and commercially it is the most important river in the province. Study your largest wall map of British Columbia, and decide where you would place the source of the Fraser. What branches of the river lie in the great mountain trench? Trace the river in its course through the interior plateau. What tributaries join it from the east? From the west?

At Lytton, the Fraser enters on its turbulent course through the Coast Range; at Hope, the mountains begin to retreat and the river flows between low banks to the Gulf of Georgia. What use have the transcontinental railways made of this great river and its tributaries? Trace their course on the map. Ask your teacher

[*Courtesy of J. Howard A. Chapman, Victoria, B.C.*

FIG. 147. INTERIOR OF A SALMON CANNERY, SHOWING THE TONS OF FISH AS UNLOADED FROM THE FISHING FLEET

to take you on a trip down the Fraser and tell you what would be seen on the way.

The south-eastern corner of the province is drained by the Columbia and its tributary the Kootenay, together with the Kettle and the Okanagan Rivers. The large wall map of Canada will show you the whole drainage system of the Columbia. What solid range must the Columbia encircle to find its way from the mountain trench to the inland plateau? You will notice that the Arrow Lakes differ from the Okanagan Lake.

(2) The slope to the west. This may include, for purposes of general survey, the short rivers flowing down the narrow gorges of the Coast Mountains to the sea from the Bella Coola to the northward. The Skeena is the large river of this district and the only one to rise in the secondary ranges of the interior, break through the

Coast Range and wear for itself a wide free channel to the sea. Find the Nass and Stikine. These rivers are not navigable for large vessels.

(3) The slope to the east. North of the Fraser, the main drainage divide leaves the Rockies and passes over to the Central range of the Cassiar group of mountains. The Findlay and Parsnip lie in the mountain trench, but uniting they break through the wall of the Rockies and flow as the Peace River to the Mackenzie system. Farther north, the Liard acts in a similar manner. This whole drainage area is as yet undeveloped. It is the hunter's paradise, a land of long silences, of untrodden forest ways, of lakes and streams, whose silent echoes have yet to wake to the crack of the rifle.

British Columbia has many beautiful lakes. These were formed during the glacial period (Fig. 94, Sec. 201), when the lower ends of long, narrow valleys were dammed by great masses of material carried by the ice. Consequently they are long, narrow bodies of deep water, and are often utilised as an easy means of transport. Large stern-wheel steamers ply regularly on Okanagan, Arrow, and Kootenay Lakes.

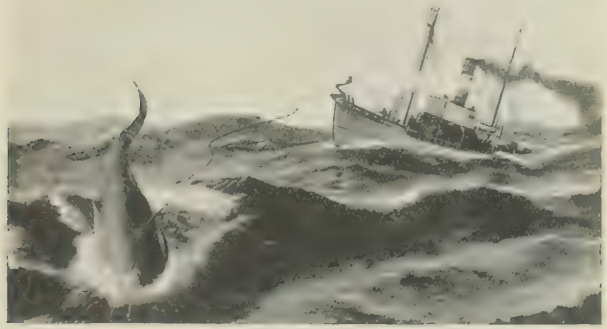
Sec. 323. Climate.—British Columbia has two well-marked and distinctive climatic areas: the Oceanic climate of the coast districts, and the Continental climate of the interior plateau and mountain trench. By a study of a good relief map or a cross-section drawn on the blackboard, the reasons for these differences of climate may be quickly grasped.

The position of the province between the 49th and 60th Parallels indicates a temperate climate in general, but the great Coast Range running parallel to the seaboard interposes itself like a massive wall to the mild influence of the Pacific. Therefore, from the crest of the Coast Range to the sea these features prevail: (1) a heavy rainfall, from 65 to 120 inches according to locality (Maps 3 and 4 in Atlas); (2) a slight range in temperature due to the ocean water and to the presence of the warm Japan Current; (3) the prevailing winds are from the sea to the land, westerly winds, and deposit a large share of their moisture in their effort to cross the mountain barrier. The heaviest precipitation occurs during the months November to March. The result of such a mild climate is that vegetation grows rapidly. Together with the States of Oregon and Washington, this part of British Columbia has the heaviest coniferous forest in North America.

Passing over the lines of serrated peaks which constitute the Coast Range, a distance of eighty miles, the winds descend to the lower levels of the interior plateau. Very little moisture is given off, with the result that large areas of the province from the 49th Parallel to Prince George are covered with short grasses, sage bush, and sentinel-like bull pines. This region is familiarly known as

the Dry Belt. Cattle ranching is the chief industry. Extremes of temperature are now experienced, and the climate is in every respect continental, although but a short distance separates one from the coast district. Due to the altitude of the interior (1,200 feet), the heat of the day is followed by cool nights, while the clear air and brilliant sunshine are rapidly making the interior plateau one of the health resorts of Canada.

When the mountains are reached, however, the rainfall increases, and heavily timbered areas appear. In the lee of the Selkirks the mountain trench presents an appearance similar to that of the interior plateau.



[*Courtesy of Department of Naval Service, Ottawa.*

FIG. 148. HARPOONING A WHALE OFF THE COAST OF BRITISH COLUMBIA

Notice the gun for shooting the harpoon on the prow of the whaling boat. The whale has just been struck and is diving.

The vegetation areas, which in British Columbia follow so closely the abrupt climatic changes, appear, therefore, in long strips running parallel with the mountain chains; *e.g.* the west coast strip, with its dense forests and heavy undergrowth; the interior plateau, with its dry range lands covered with grass; the Selkirk uplift, with its blue-clad slopes covered with another dense forest; and the dry range lands of the mountain trench.

These features are clearly defined south of the line of the Grand Trunk Railway. North of that line, the higher altitude of the plateau level together with the less continuous configuration of the mountains permit a more equable distribution of moisture, and a fairly heavy coniferous forest stretches from the coast to the crest

of the Rockies. East of the Rockies, the Peace River area presents a view of undulating slopes of wonderful fertility, where meadows, shoulder high in natural grasses, alternate with clumps of trees, a park-like country, well adapted to mixed farming.

Industries

Sec. 324. Lumbering.—The greater part of British Columbia is covered by forests (Fig. 149), and more than half the marketable timber of Canada is situated in this province. On parts of the interior plateau and the eastern slopes of the mountains, the trees are scattered and small owing to the dryness of the climate. But on the western slopes of the mountains, where there is sufficient rainfall, and especially on that of the Coast Range, are some of the densest forests of giant trees to be found anywhere in the world. The Douglas fir, which grows to a height of two hundred feet, is by far the most important. Formerly it was used principally for making spars for vessels. Now, on account of its fine grain, hardness, toughness, beautiful finish and cheapness, it is a favourite wood for many structural purposes. The red cedar, a still larger tree, makes excellent shingles. Since the most valuable forests are situated on the western slope of the Coast Mountains quite near the much-indented coast, and on Vancouver Island, the logs can be readily brought to tide-water. Here they are made into huge booms or rafts, and are then towed to some convenient harbour, where they are cut into lumber at the sawmills. For many years the Prairie Provinces provided the chief market for the lumber industry of British Columbia, but as the lumber industry grew it sought wider markets, and at present shipments are made to Japan, China, South Africa, Australia and several other countries.

Sec. 325. Agriculture.—Owing to the great parallel mountain chains which traverse British Columbia from north to south, the areas of fertile lands are found in the river and lake valleys which lie between the mountain ridges. Settlement in the province is therefore confined to well-defined districts, each in turn separated from its neighbour by a mountain barrier. In the southern part of the province a number of very fertile valleys are now under development. Irrigation systems have been installed, orchards have been set out on the gently sloping bench lands, and fruit-growing is advancing by leaps and bounds. In the Okanagan and Kootenay Lake districts, apples are the prime crop, followed by peaches, pears, cherries, plums and small fruits. On the vast ranges of the Similkameen and Central Fraser system the sweet bunch grass provides a natural food for thousands of cattle, horses and sheep.

FIG. 149. A FOREST ON VANCOUVER ISLAND, SHOWING THE GIANT DOUGLAS FIR

Farther north, the Nechako and Bulkley valleys are opening up and mixed farming prevails.

At the coast, the large delta lands of the Fraser, and the equally fertile lands of the Courtenay, Duncan and Saanich districts on Vancouver Island, provide rich pastures and meadows. Dairying is the important industry. On the higher land, large quantities of small fruits are grown, principally strawberries, raspberries and loganberries. Poultry raising has grown to large proportions within recent years.

Sec. 326. Mining.—The chief minerals of British Columbia have already been named (Sec. 226, Figs. 99, 146). Since 1860 over seven hundred million dollars' worth of minerals have been won from the mountains and valleys of this province. In the production of this huge total, gold at first held undisputed sway; but with the decline of placer mining during the 'eighties, coal assumed the leading position, and has only in recent years been challenged by copper. Coal is mined at Nanaimo and Cumberland on the east coast of Vancouver Island, near Fernie in the Crow's Nest Pass, and at Merritt and Princeton in the Nicola and Similkameen valleys. The copper mines are located at tide-water. The largest is at Anyox on Observatory Inlet and produces at the rate of forty million pounds a year. In the past great quantities of gold have been obtained from the sands of the Fraser and its tributaries and from the Big Bend of the Columbia; but now a considerable amount is extracted from the crushed rock by means of *lode mining*. Large producing mines are located at Rossland and near Stewart at the head of Portland Canal. Silver, lead and zinc are mined extensively in the Kootenay district. The famous Sullivan lead-zinc mine is located at Kimberley.

Sec. 327. Fishing.—In this industry British Columbia leads the provinces of the Dominion. This is chiefly due to the catch of one variety, and that the most valuable food fish in the world, the Pacific salmon. The salmon are of several varieties, the most valuable being the sockeye. Other varieties are the cohoe, spring, pink and chum salmon. The sockeye averages about six pounds in weight and twenty-three inches in length. Its flesh is brick-red in colour and rich in oil. During the months of June, July and August the salmon come in from the sea in their countless thousands. They ascend the rivers, drive through the rapids and leap up the waterfalls, until bruised and weary they pass to the quiet waters along the sand bars of the ponds and lakes at the heads of the streams. Here they spawn and die; their life cycle is completed, no mature salmon swims back to the sea. The eggs hatch out in the warm summer suns, and the small fry pass out as fingerlings the next year to the sea. Here they live and grow for the next three and

sometimes four years. The many islands and bays, the many inlets and canals along the coast provide thousands of miles of sheltered waterways as well as kelp-beds and seaweed. At the end of the appointed time the mature salmon gather for the long journey to the spawning grounds. Instinct guides each salmon back to its birthplace. Those hatched on the shores of Harrison

[*Courtesy of Canadian National Railways.*

FIG. 150. AN INDIAN CAMP AT TÊTE JAUNE CACHE, B.C.
The Indians are Shuswaps.

Lake in 1916 return to that lake in 1920. To aid in restocking the streams, the Dominion Government maintains twelve hatcheries, where a hundred million salmon eggs are yearly gathered. When the young fry are able to fend for themselves, they are released and quickly make their way to the sea.

It is while entering the rivers that the sockeye is captured by the fishermen. Many kinds of nets are used and immense numbers of salmon are caught. They are taken at once to the canneries

FIG. 151. VICTORIA HARBOUR, BRITISH COLUMBIA *(Courtesy of Canadian Pacific Railway*

To the left is the Empress Hotel. The large building beyond the harbour is the parliament house.

which are situated on the river banks and inlets near the fishing grounds. Large canneries are in operation at the mouths of the Fraser, Skeena and Nass Rivers, and at the head of Rivers Inlet.

The halibut and cod banks are located off the west coast of Vancouver Island, and around the Queen Charlotte Islands. Prince Rupert is the central receiving point for the halibut, which is frozen and shipped to the United States and Eastern Canada.

Whaling is carried on mainly from Kyuoquot on the west coast of Vancouver Island, and Naden Harbour in the Queen Charlotte's. In addition to the production of whale oil from the blubber, the remainder of the carcass is made into a valuable fertiliser.

Sec. 328. *Victoria*, the capital, situated at the southern end of Vancouver Island, is a beautiful city, somewhat English in appearance and spirit (Fig. 151). Lumber mills dot the inner harbour, while a huge breakwater provides safe berthing for the largest trans-Pacific liners. It is now one of the chief tourist resorts of the Pacific coast.

Vancouver, the largest city west of Winnipeg, has had the most phenomenal growth of any city in Canada. Its original development was due to the fact that it was the western terminus of the Canadian Pacific Railway. It has one of the best natural harbours in the world and has regular steamship connection with Alaska, Victoria, Puget Sound, San Francisco, Japan, China, Australia and New Zealand. Moreover, it is the centre of the lumbering industry of British Columbia, and is also a manufacturing town and a distributing centre for the whole province (Fig. 146).

New Westminster, a fresh-water port, is situated on the Fraser River in a good agricultural region. Before the rise of Vancouver it was the most important town on the mainland.

Prince Rupert, the terminus of the northern trans-continental line of the Canadian National Railways, is situated on the Pacific coast five hundred miles north of Vancouver. It has an excellent harbour and will become the great commercial city of the north.

Nanaimo is situated on the east coast of Vancouver Island. It is the centre of the coal-mining industry.

Kamloops (an Indian name meaning "the meeting of the waters") is strategically situated at the junction of the North and South Thompson Rivers. It is the chief city of the dry belt, and a noted health resort.

Prince George controls the trade of the upper Fraser system.

Armstrong, *Vernon*, *Kelowna* and *Penticton* are growing towns in the Okanagan Valley, where fruit is king.

Nelson is the centre of trade for the Kootenay district.

Fernie is the financial and residential town of the Crow's Nest coal-fields.

CHAPTER XXIII

NEWFOUNDLAND

Sec. 329. Position.—Newfoundland, the oldest of Great Britain's colonies, holds a commanding position at the entrance to the Gulf of St. Lawrence. It is separated from Labrador by *Belle Isle Strait* and from Cape Breton by *Cabot Strait* (Map 21 in Atlas).

Sec. 330. Shape and size.—It is the tenth largest island in the world, and except for some little-known islands in the Arctic Ocean, the largest in the Western hemisphere. In shape it resembles a triangle, but the north-eastern side is very much broken.

Sec. 331. Coast-line.—Like the Maritime Provinces, Newfoundland has a very irregular coast-line. Numerous deep bays and fiords run far into the land, sometimes so nearly piercing the island that all the early maps represented Newfoundland as a number of islands. These indentations afford excellent harbours for fishermen.

Sec. 332. Surface.—The coast of Newfoundland is high, rocky, and austere, and to one approaching it from the water it looks forbidding and barren. But the interior is a highland with many stretches of fertile soil. The ridges, which are nowhere high, run in the characteristic direction of the mountains of the Appalachian system; indeed, one may consider them as a continuation of the ridges of Nova Scotia. There are so many lakes and ponds that from a single hill over sixty may be counted on a clear day. It has been estimated that over one-third of the whole area is covered with water.

Sec. 333. Climate.—Owing to the moderating influence of the surrounding water, the climate of Newfoundland in winter is not cold and severe, as many think (Maps 10 and 11 in Atlas). The island is, in fact, warmer than the adjoining part of Canada. Indeed, the temperature seldom drops to zero. This mildness of climate is produced by the winds from the Gulf Stream to the south, but unfortunately they bring also much fog with them. In the spring, the cold Labrador Current forces much drift-ice against the east coast, making this season damp, chilling, and unpleasant. The summers and autumns are bright, warm, and delightful.

Industries

Sec. 334. Fishing.—For four hundred years fishermen have gone to the Banks of Newfoundland, a comparatively shallow region off

[Courtesy of Canadian National Railways.

FIG. 152. QUIDI-VIDI, A FISHING VILLAGE IN NEWFOUNDLAND

What is the character of the country? Is it suitable for farming?

the south-east coast, where fish are abundant (Fig. 106). These bank fishermen come mostly not from the island but from distant seaports like Lunenburg in Nova Scotia, and Gloucester in Massachusetts. The islanders fish closer to the shore, using trap-nets instead of the trawls employed on the Banks. Practically the whole population was formerly scattered along this coast in order to engage in these fisheries, and a large proportion of the people are still occupied with this industry. To the Newfoundlander "fish" means "cod-fish." During June and July the cod come in close to the south and south-west coasts to feed on a small fish called the capelin, which then swarms in the coves and inlets and which is succeeded first by the squid or cuttle-fish and then by the herring. The fishermen take advantage of these movements and catch numbers of cod in nets of various kinds which they set along the shore. Others sail in small fishing-smacks to the coast of Labrador, set their nets in the coves, and cure the fish on the beach. Lobsters are trapped all around the coast of Newfoundland (Fig. 106), and herrings are netted along the western shore. The seal fishery is carried on by crews of about two hundred men, who sail north in the spring and kill the young seals on the ice-floes. This is dangerous and exciting work, but very profitable, as the skin and fat of the seals are of great commercial value. Whale fishing, which had almost died out, has been renewed in recent years. The whales are harpooned and killed by men in small ships, and their carcasses brought by the whaling vessels to one of the small factories along the north-east coast. Here the fat or blubber is rendered into oil, the whalebone extracted from the mouth, and the flesh and offal converted into fertiliser called *guano*. The genuine guano, however, is the dried droppings of certain sea-birds on the western coasts of South America.

Sec. 335. Mining.—Many of the rock formations of Newfoundland are quite similar to those of the Canadian Shield, and the coal-bearing rocks of Cape Breton Island are continued into the western region of Newfoundland. Undoubtedly, in the future, many valuable minerals will be found in this island. At the present time, however, the only two minerals extensively mined are iron and copper. From a small island not far from St. John's is obtained almost all the iron ore used in the smelting furnaces of Sydney, Nova Scotia, and considerable quantities of copper are being mined on the north side of the island.

Sec. 336. Lumbering.—There are many extensive timber forests in the interior of the island. The most important trees are red and white pine, spruce, birch, and poplar. A magnificent pulp and paper factory has been established at *Grand Falls*, which utilises the waterfall for motive power. The product of this factory is used for British newspapers.

Sec. 337. Agriculture was discouraged for centuries in Newfoundland, and even yet the adventurous, hazardous occupation of fishing is too attractive to the islander to be forsaken for the less exciting but more profitable occupation of farming. Besides, up to a few years ago, the interior, where the best farming land is to be found, was entirely unknown. When the railway, which crosses the island from east to west, was completed, the real development of the island began, and farming has made steady progress ever since. The chief crops are hay, potatoes, turnips, and cabbage; and horses, cattle, and sheep are increasing in numbers. Of course Newfoundland is not likely soon to export much agricultural produce, but it is quite possible that its farmers may within the next few years raise a large proportion of the foodstuffs required by themselves.

Sec. 338. Game.—In the central part of Newfoundland are many tracts of wilderness untouched by man and teeming with game. The caribou, a variety of reindeer, is hunted by numerous sportsmen. Bears, wolves, beavers, and foxes are also plentiful, and trout and salmon abound in the streams of this region.

Sec. 339. Cities.—The greater part of the population is scattered along the coast (Fig. 152), and since every fisherman catches, cures, and sells his own fish, there are very few cities or towns. The largest of these, *St. John's*, has a population of forty thousand, and is situated on a beautiful land-locked harbour on the east coast. It is the only important city on the island, being at once the capital and the chief commercial centre. The Governor, appointed by the British Government, resides in this city.

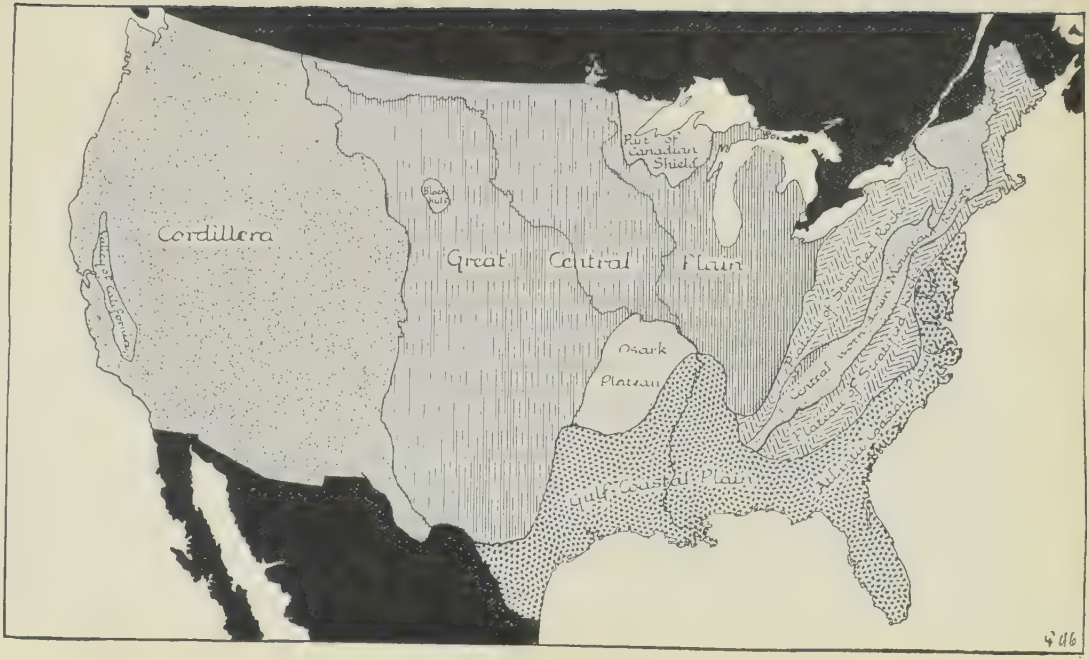
CHAPTER XXIV

UNITED STATES AND ALASKA

Project

Sec. 340. Why has the United States become such a wealthy country?—From what four continents is the United States readily accessible by water? (Map 2 in Atlas.) Which sides of it are bounded by oceans or seas? Of what great advantage is this kind of boundary? What important bodies of water form part of the northern boundary? Are these waters navigable? Does the Mississippi flow through a flat or a mountainous country? (Map 25 in Atlas.) Would you expect it to have waterfalls and rapids, or to be easily navigable? Through what parts of the United States can roads and railways most easily be built? Why? Name all the natural features of the United States which make transportation easy. (The three essentials for vegetable growth are summer warmth, spring and summer rains, and good soil.) What proportion of the United States has an average temperature above seventy degrees in July? (Map 11 in Atlas.) What proportion of Europe has the same average for the same month? (Map 36 in Atlas.) Compare the July rainfall in the non-mountainous part of the United States with the rainfall in Europe, Asia, and Africa for the same month (Map 4 in Atlas). What part of the United States has a soil, a summer temperature, and a rainfall suitable for vigorous growth? What great advantage in climate has the United States over Canada? What parts of the United States are covered with forests? (Map 9 in Atlas.) What part of the surface of the United States is mountainous? (Map 25 in Atlas.) What two kinds of wealth are obtained from mountainous regions? Whence did the first settlers of the United States come? What advantage did the character of her early settlers give her over Mexico and South America? What race of people were introduced as labourers into the Southern States? How did these labourers assist production? The most important export of the United States is cotton. Why would its production be impossible except for these imported labourers? (Sec. 148.)

Sec. 341.—The United States is one of the wealthiest countries of the world. In the two great basic industries of agriculture and mining she far surpasses every other country. She grows more wheat, oats, corn, and cotton, and mines more iron, copper, coal,


Cordillera
Great Central Plain
Ozark Plateau
Gulf Coastal Plain
Black Hills
Part of Canadian Shield
Part of Canadian Shield
Coastal Plain
Appalachian Plateau
Piedmont Plateau
Coastal Plain
Coastal Plain
Coastal Plain

lead, zinc, and petroleum than any other country; indeed, she produces larger quantities of corn, cotton, sulphur, copper, and petroleum than all the rest of the world put together. Let us endeavour to find what conditions have led to the growth of such wealth.

Boundaries, Extent, and Coast-line

Sec. 342. Boundaries and extent.—The United States is bounded on the north by Canada, on the east by the Atlantic Ocean, on the south by the Gulf of Mexico and Mexico, and on the west by the Pacific Ocean. In shape the country is rectangular, and in size it is only a little smaller than the Continent of Europe. It is not, however, the largest country in North America, the Dominion of Canada surpassing it considerably in area.

Sec. 343. The coast.—The coast of the United States is much more regular than the coast of Canada. The Atlantic coast-line as far south as New York has many narrow, fiord-like indentations and projecting peninsulas, and it is fringed with numerous islands. In this respect it resembles the Atlantic coast of Canada, and like it has many excellent harbours, such as those of *Portland*, *Boston*, and *New York*. The cause of these irregularities has been explained already (Sec. 182). South of New York the character of the coast-line changes. The land rises gradually as it recedes from the water, and the coast-line is regular except where the estuary of a river breaks through. The two harbours, *Philadelphia* and *Baltimore*, are on branches of two of these estuaries, namely *Delaware* and *Chesapeake Bays*. The only important island along this coast is *Long Island*. The Peninsula of Florida, which cuts off to a great extent the Atlantic Ocean from the Gulf of Mexico, has a regular coast-line bordered by limestone reefs, which have been built up by small animals called *coral polyps*. The Gulf Coast has no important bay, and the only important peninsula is formed by the Mississippi delta, which projects one hundred miles out into the water. Moreover, as the water deepens very gradually it is difficult for ships to approach the coast, and consequently there are few good harbours. The Pacific coast-line has been sufficiently described already (Sec. 182).

The general features of the surface have been described in Sec. 183, and Fig. 153 shows the natural divisions.

The Atlantic and Gulf Coastal Plains

Sec. 344.— From Maine to New York City the Appalachian Highlands extend eastward right to the coast. From New Jersey to Alabama they are separated from the coast by a low plain, which

[*Courtesy of Illinois Central Railway.*

FIG. 154. COTTON PICKING IN TENNESSEE

Note the kind of labourers. How high does the cotton plant grow?

slopes gently from the highland to the ocean. This *Atlantic Coastal Plain*, as it is called, has been formed by a steady elevation of the coast, accompanied by a recession of the ocean waters. It increases in width toward the south as far as the State of Georgia, where it is 120 miles wide, and it extends continuously from the southern end of the Appalachian Highlands to the Gulf Coast, where it is called the *Gulf Coastal Plain* (Fig. 153). This plain gradually blends with the much wider alluvial flats of the delta of the Mississippi, which extend north almost to the mouth of the Ohio River. West of this delta the plain is continued through the State of Texas. Since this coastal plain was formerly a sea-bottom, it is very level, and is composed largely of fertile sediments. Consequently it, as well as the delta of the Mississippi, is almost entirely devoted to agriculture.

Sec. 345. Climate.—Even the most northerly part of the Atlantic Coastal Plain is farther south than South-western Ontario, and consequently the winters are comparatively mild. Farther south along the Gulf Coast the average January temperature is between fifty and sixty degrees, and frosts are very rare, even in winter. Though the summers of the Atlantic region are warmer than in Southern Canada, the proximity to the water has a cooling effect. Along the Gulf Coast, however, the hot, humid atmosphere of summer is very depressing (Maps 10 and 11 in Atlas).

The east and south-east winds, which frequently blow over the coastal plain from the Atlantic Ocean, bring a sufficient rainfall throughout the year to the whole Atlantic Coastal Plain. On the Gulf Coast the prevailing winds during the summer are from the Gulf toward the heated interior, and throughout the winter south-east winds are frequent. Consequently, in this region there is an abundant rainfall throughout the whole year (Maps 3 and 4 in Atlas).

Industries

Sec. 346. Agriculture.—As we might expect from the level surface, the fertile soil composed of sediments washed down from the land, the abundant rainfall, and the great warmth of summer, agriculture is the leading industry. Along the northern part of the Atlantic Coastal Plain in New Jersey and Delaware, where the springs are very early, truck farming is widespread. Barley and vegetables are grown and the latter are shipped to the Northern States and to Canada. In the Southern States the chief crop is cotton (Fig. 154), for the growth of which every condition is favourable (Fig. 155). The soil and climate are suitable, and the large negro population supplies an abundance of cheap labour for

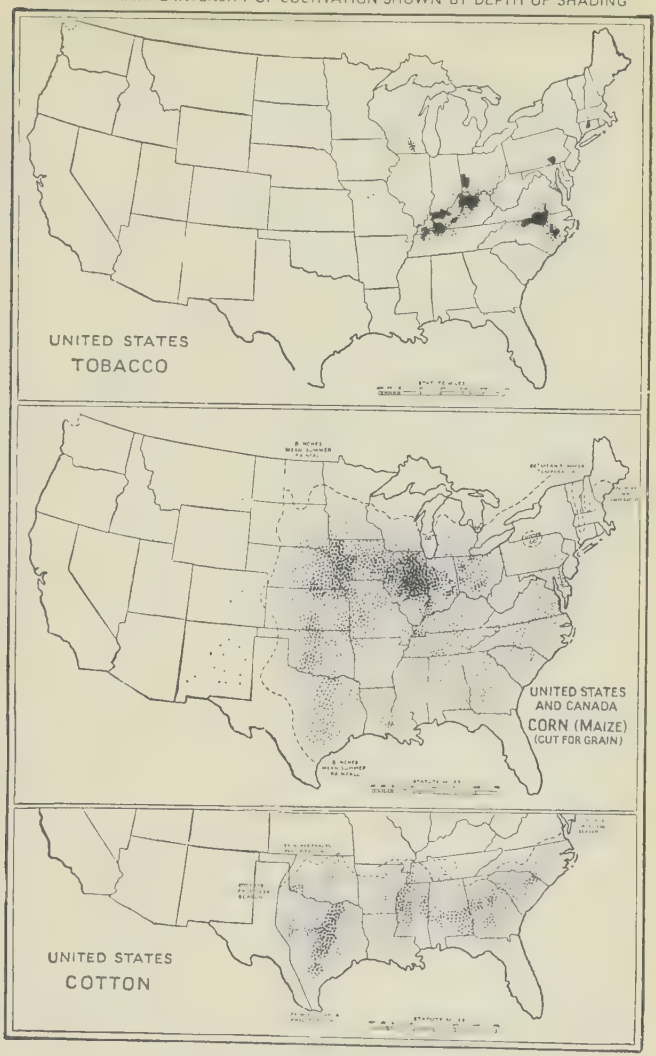


FIG. 155. DISTRIBUTION OF TOBACCO, CORN, AND COTTON IN THE UNITED STATES

Name the chief tobacco, corn and cotton states.

the picking of the crop, which must be done by hand. Cotton is grown in the region bounded on the north by a line extending from North Carolina to Oklahoma, and on the south by the Gulf of Mexico. This fibre, of which three-fifths of the world's supply is grown in this belt, forms by far the most valuable export of the United States.

Though at one time the rice crop of the United States was largely produced on the Atlantic Coastal Plain, the area of chief production is now the coastal prairie of Texas and Louisiana. The reason for this is stated in Sec. 136. The production of sugar-cane is concentrated in the Mississippi delta in Louisiana, but small quantities are produced throughout the Southern States. Corn in large quantities is raised throughout both the Atlantic and Gulf Coastal Plains and is a chief article of food in the Southern States (Figs. 155 and 159).

Since Florida is a peninsula extending five hundred miles south of the adjoining states, and is bordered on three sides by the warm waters of the Gulf of Mexico and the Atlantic Ocean, its climate is almost tropical. Consequently, tropical fruits, and especially oranges and pine-apples, are very important crops, the latter being raised nowhere else in the United States.

Sec. 347. Minerals.—A coastal plain, which is composed of land sediments, is not likely to contain many minerals, and, consequently, very little mining is carried on in any part of this region, except in Texas and Louisiana. In the former are many petroleum wells, and in the latter is obtained quite half of the world's supply of sulphur.

Cities

Sec. 348.—This region has no water-power and possesses no coal mines. Therefore it lacks some of the essential requirements of an important manufacturing country. The cities in a region devoted so exclusively to agriculture are centres for the collection of the farm products for export and for the distribution of the imported manufactured goods required by the region. As a result, the cities are situated on the harbours and rivers. *New Orleans* (Fig. 71), on the Mississippi near its mouth, is the most important city of the South. All the produce brought down the Mississippi and its tributaries on river boats is here unloaded, and much of it, especially the cotton, is exported on ocean vessels. *Galveston* in Texas and *Mobile* in Alabama are also important seaports, from which large quantities of cotton are exported. On the Atlantic coast, the principal seaports are *Charleston* in South Carolina and *Savannah* at the mouth of a river of the same name.

The Appalachian Highlands

Sec. 349. Surface.—This region, extending from Maine to Central Alabama, consists of a central worn-down mountain range bordered on each side by a wide plateau of stratified rocks. The surface of the plateau is neither very high nor very rough, and in many parts is suitable for cultivation. The central core running from south-west to north-east is only the base of what was formerly a high mountain range, and the igneous and metamorphic rocks which now appear at the surface were at one time covered by thousands of feet of rock, which has been worn away by erosion.

Many of the important rivers of the region west of the plateau cut gorges across the mountains and empty into the Atlantic Ocean (Map 25 in Atlas). These gorges, which are called *water-gaps*, have played a leading part in the development of the great cities on the coast. One of the most northerly of the water-gaps is cut by the *Mohawk* and *Hudson* Rivers, and through it the first railway was built connecting the Atlantic sea-board with the Great Central Plain. New York, the commercial centre of the United States, is situated on the Atlantic coast at the eastern end of this famous water-gap and owes much of its importance to this fact. Philadelphia occupies the eastern end of the water-gap of the *Susquehanna River*, and Washington the eastern end of the water-gap of the *Potomac River*.

Sec. 350. Climate.—An adequate supply of rain is brought to this region by the moist south-east winds, which blow intermittently from the Atlantic Ocean. In the southern part, though the weather is never severe, on account of its greater altitude it is cooler than on the coast, and the people of the plains to the east and west resort to it in the summer. In the northern part, and especially in the New England States, the temperature is very much like that of New Brunswick, cold in winter with heavy snowfall and warm during the summer (Maps 3, 4, 10, 11, and 12 in Atlas).

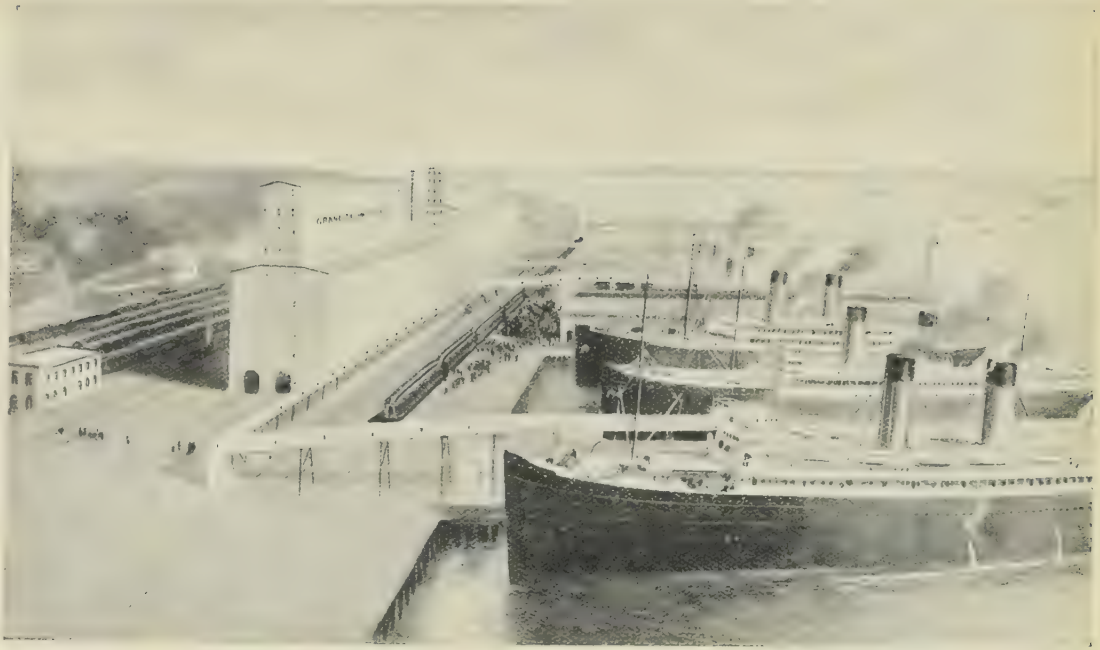
Sec. 351. Industries.—The land on the marginal plateaux both east and west is fairly level and has much fertile soil. In the New England States, which were formerly covered by the glacier, the surface of many of the higher parts is stripped of soil, but in the lower regions are many thick deposits of boulder clay, which is intensively cultivated. As many of the largest cities in the United States are near to New England, the people engage extensively in truck farming, selling the products in these centres. On the western side of the plateau, in New York and Pennsylvania, mixed farming is the most important branch of agriculture, and large quantities of butter and cheese are manufactured. In fact,

New York is the greatest dairying state in the Union. On both the east and west sides of the southern part of the plateau are the chief tobacco plantations of the United States, Kentucky on the west and Virginia and North Carolina on the east being the leading producers (Fig. 155).

Sec. 352. Lumbering.—This whole region was originally covered with forest, but in the north the best of the lumber has been cut. In the New England States, however, much lumbering is still carried on, and large saw-mills are situated along the numerous rivers. The southern or *Georgia pine* is a very important timber tree of the South, and the Carolinas and Georgia export large quantities of lumber, a great deal of which is shipped to Canada.

Sec. 353. Mining.—Large quantities of coal, petroleum, and natural gas are obtained from the rocks of the Appalachian region. The greatest beds of anthracite, or hard coal, mined anywhere in the world, are in Eastern Pennsylvania, in the neighbourhood of *Scranton* and *Wilkesbarre*. As this is the only hard coal found in the United States, it is shipped very widely to the Northern States as well as to Canada. The most important supplies of soft coal come from Western Pennsylvania, West Virginia, and the states at the southern end of the Appalachian region. *Pittsburgh* is at the centre of the coal-mining region of Western Pennsylvania, and the *Pocahontas* mine in West Virginia is notable for the large quantities of coal taken from its depths. For many years petroleum was obtained in larger quantities from Pennsylvania, Ohio, and West Virginia than from any other part of the world, and a great deal is still obtained from this district, though it has recently been outstripped by California and Oklahoma and is rivalled by Texas. The wells in this region have been supplying oil so long, that many are showing signs of exhaustion. Large quantities of natural gas are found in the same localities as the petroleum. Though there are considerable quantities of iron distributed throughout the Appalachian region, vast quantities have to be imported for manufacturing purposes. In the New England States granite, marble and other building stones are extensively quarried.

Sec. 354. Manufacturing.—The northern part of this region is the greatest manufacturing centre in the United States. Besides the convenient supplies of coal, the swift rivers furnish water-power. In the New England States the manufacturing of cotton and woollen cloths, which was begun in the eighteenth century in the people's homes and later was transferred to factories, has continued until the present day, and the cotton and woollen factories of Massachusetts and Connecticut are the largest and most numerous in the United States. Pennsylvania mines iron-ore, coal, and limestone, which are fortunately found close together, since the



[*Courtesy of Grand Trunk Railway.*

FIG. 156. HARBOUR OF PORTLAND, MAINE, THE ATLANTIC TERMINUS OF THE GRAND TRUNK DIVISION OF THE CANADIAN NATIONAL RAILWAYS

Notice the grain elevators.

two latter are necessary to extract the iron from the ore. The manufacturing establishments of Pennsylvania for producing pig-iron are the largest in the world. But the local supply of iron-ore is insignificant compared with the immense quantities brought down from Northern Michigan through the Great Lakes. Pennsylvania smelts more than one-half of the iron and steel used in the United States, and Pittsburgh alone more than one-tenth. In this same district are manufactured very large quantities of goods made of iron and steel.

Cities

Sec. 355.—Several of the most important cities have already been named. *New York* is the commercial metropolis for North America. It has excellent connection with the Great Lakes and the West both by numerous railways and by the Erie Canal. Consequently, many of the products of the Great Plain are exported through New York, and many of the imports for the Western United States and Canada pass through the same port. *Brooklyn*, *Newark*, *Jersey City*, and *Elizabeth* are really suburbs of New York. *Philadelphia* and *Baltimore*, farther south, are also collecting and distributing centres. *Boston*, a fine sea-port, is the centre of New England life, and exports many of the manufactures of the region. It is the intellectual centre of the country, and Harvard University, the oldest and most noted on the continent, is situated in one of its suburbs. *Washington*, on the Potomac River, the capital of the United States, is not included in any states, but in the district of Columbia, which has a special form of government. *Pittsburgh* has already been mentioned. In *Paterson*, New York State, there are over two hundred silk-mills, which manufacture more of this fabric than is produced in any other city of America. *Buffalo* in New York and *Erie* in Pennsylvania are great commercial ports on Lake Erie, which receive the iron-ore and grain brought from the west through the Great Lakes, and ship coal, petroleum, and other products to be distributed through the west.

Great Central Plain

Sec. 356. Surface.—Between the Appalachian Highlands on the east and the Cordillera on the west lies a great plain which slopes from both sides toward the Mississippi River. One can travel over it for hundreds of miles and see no high hills (Map 25 in Atlas). In fact, the only two considerable elevations are the *Black Hills* in Western Dakota and *Ozark Mountains* in Missouri.

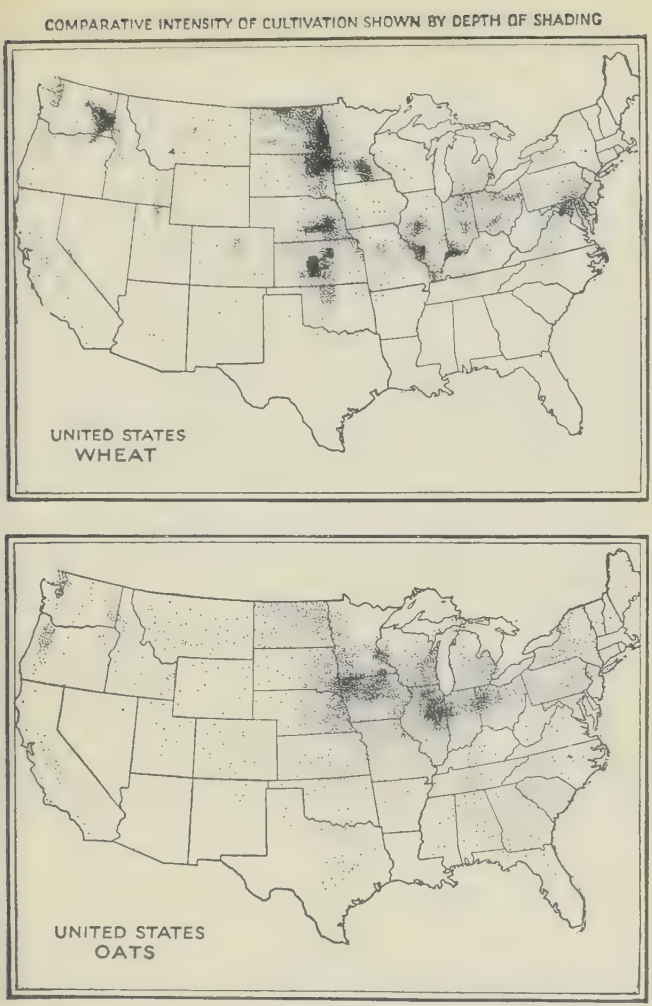
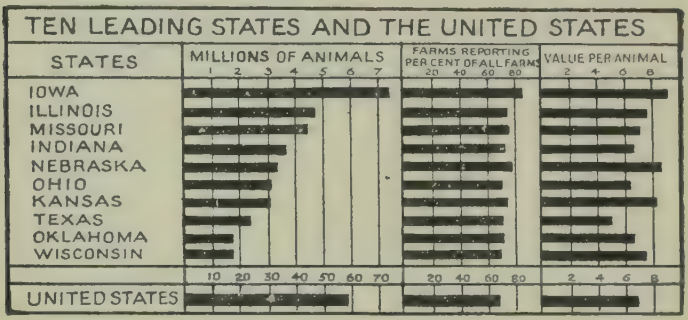


FIG. 157. DISTRIBUTION OF WHEAT AND OATS IN THE UNITED STATES

Name the four chief wheat-producing regions. Which one is continuous with the wheat-producing region of the Canadian Prairie Provinces?

Sec. 357. Climate.—Although this region is far from the Gulf of Mexico and still farther from the Atlantic Ocean, moist winds blow from these bodies of water every few days, and cause an amount of rainfall over most of the region sufficient for the growth of excellent crops. The rainfall, however, diminishes toward the



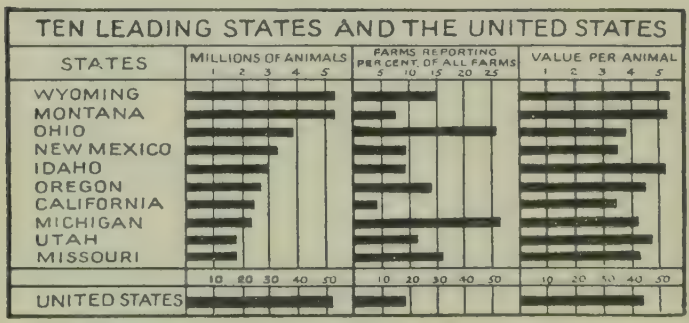


FIG. 158. DISTRIBUTION OF SWINE AND SHEEP IN THE UNITED STATES

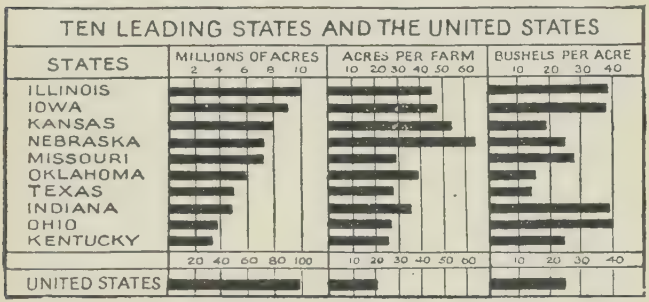
What regions of the United States produce the greatest number of swine and sheep respectively?

Cordillera, and becomes so small in Western Texas, Oklahoma, Kansas, Nebraska, and the Dakotas, that farm crops are grown only where the land is irrigated (Maps 10, 11, and 12 in Atlas).

The whole region is far away from the ocean and does not feel its moderating influence. Consequently it has a continental climate, hot in the summer and cold in the winter. In the vicinity of the Great Lakes is felt the moderating influence of these waters,

which makes the summers cooler and the winters milder than in the adjoining country to the east and west.

Sec. 358. Drainage. —Almost the whole region is drained by the Mississippi River and its tributaries. The chief tributaries are on the east the Ohio, and on the west the Missouri, the Arkansas,



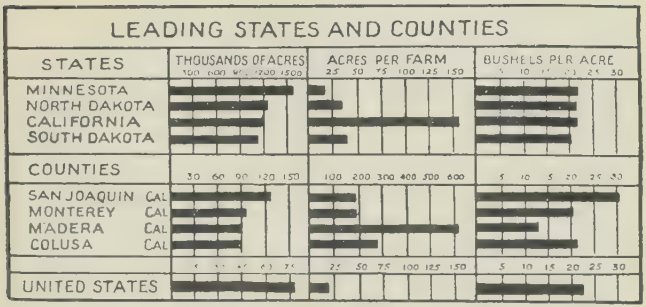


FIG. 159. DISTRIBUTION OF CORN AND BARLEY IN THE UNITED STATES

Name the five states producing most corn, and the four producing most barley.

and the Red. All these rivers, flowing through a wide plain, are navigable for the greater part of their courses.

Sec. 359. Agriculture. —The extensive Central Plain produces more food than any other region in the world, and the meat, bread, and cereals, which feed not only the United States, but also a considerable part of Europe, are grown on the farms that cover its surface. Across the central part of this region from Ohio to Nebraska is the "corn belt," on which are grown immense quantities

of this cereal (Fig. 155). But corn is also grown extensively in all the states of this great plain. Wheat, barley (Fig. 159), and oats are very widely raised throughout that part of the Great Central Plain east of the arid belt bordering the Cordillera. The largest quantities of wheat are produced in the Red River Valley of Dakota and Minnesota, and in Nebraska and Kansas (Fig. 157). The Dakota wheat belt adjoins the best wheat land of Manitoba and Saskatchewan. Hay is grown extensively everywhere, flax in the Red River Valley (Fig. 73), sugar-beets in Michigan, and apples, pears, peaches, and grapes in the vicinity of the Great Lakes, where the moderating effect of the water is felt. A good deal of hay, corn, and oats are used as food for cattle and swine, which form two of the chief exports of the region (Fig. 158).

Sec. 360. Ranching.—The irrigated part of the arid belt bordering the Cordillera is very small, and the rest is a prairie, which is covered with bunch grass, suitable as food for cattle. Ranching is the chief industry of the belt. The land, which is owned in great part by the government, is not fenced, and is free feeding ground for the cattle of any who wish to use it. Ranchers settle near the wooded banks of the rivers, build their cabins, fence enclosures, in which cattle may be kept, and then allow them to wander over the prairie. Each rancher has his own brand on his animals, and about twice a year the cattle of the different owners are rounded up and sorted out. The men who look after the cattle are called *cow-boys*.

Sec. 361. Mining.—Coal is found in almost every state in the Great Central Plain, and gas and petroleum are also widely distributed. The greatest iron mines in the world are situated round the western end of Lake Superior, and some of the greatest copper mines in the world to the south of the same lake. The chief lead and zinc mines of the United States are in the Ozark Mountains in Missouri.

Sec. 362. Lumbering.—A large part of the region is treeless, but the forests of Michigan and Minnesota, though they have been cut over for many years, are still extensive and supply much lumber.

Sec. 363. Manufacturing.—With coal in almost every state, excellent water-ways, a level surface over which roads and railways can be readily made, and abundance of such important raw materials as iron, copper, lumber, and grain, manufacturing, though still in its infancy, cannot fail to increase. Large amounts of flour and cereals are being made from the grain, furniture from the lumber, and agricultural implements and other articles of metal from the iron and copper.

Sec. 364. Cities.—The cities are great collecting and distributing centres, to which are gathered the farm products from the sur-

[*Courtesy of Armour and Company, Chicago.*

FIG. 160. COOLING ROOM IN ARMOUR AND COMPANY'S PACKING HOUSE, CHICAGO

[*Courtesy of Northern Pacific Railway.*

FIG. 161. GIANT GEYSER, YELLOWSTONE NATIONAL PARK

Where is the Yellowstone National Park? (See Map 25 in Atlas.) Taking the people standing near as a guide, about how high does the steam rise?

rounding regions for export, and from which are distributed manufactured goods required by the agriculturists. Consequently, the cities are situated on the chief bodies of water, the Great Lakes, and on the Mississippi River and its tributaries. *Chicago*, the second largest city on the continent, is situated on the south-western coast of Lake Michigan at a point through which every railway must pass that runs between the Eastern States and the north-west of the Great Central Plain. It is also conveniently situated for lake traffic. Since coal from Wisconsin and iron and copper from the Lake Superior region can all be readily brought to Chicago by boat, it has become a great manufacturing centre. *Detroit*, the fourth largest city in the United States, is situated where the line of water traffic on the Great Lakes is crossed by the trunk railway lines which connect Chicago with New York. It is thus an excellent shipping point and it has also become a great manufacturing city, more motor cars being made there than in any other city in the world. *Cleveland*, on Lake Erie, receives most of the iron ore that comes from Lake Superior and sends forward much of it to the Pittsburgh region. Besides, Cleveland has abundant supplies of both petroleum and natural gas close at hand and is a great manufacturing city. *St. Louis*, which is on the Mississippi River near its junctions with the Missouri and with the Ohio, is conveniently situated to receive the grain and cattle of the north, and the cotton and tobacco of the south. It manufactures large quantities of tobacco. Several bridges across the Mississippi River are in its vicinity. *Cincinnati* on the Ohio River and *Milwaukee* on Lake Michigan manufactured until recently large quantities of beer and other liquors. *Kansas City* and *Omaha*, which are growing rapidly, are centres of the meat-packing industry. *Minneapolis* and *St. Paul*, situated near the source of the Mississippi River, are only twelve miles apart, and are called the Twin Cities. They are both great wheat markets, and also have large manufacturing establishments. The largest flour mill in the world is in Minneapolis.

The Cordillera

Sec. 365. Surface.—The surface of the Cordillera was described in Sec. 183.

Sec. 366. Climate.—There is an abundant rainfall on the north-western coast of Washington State, but the precipitation along the coast decreases rapidly toward the south, especially during the summer (Maps 3 and 4 in Atlas). This is due to the fact that the westerlies, which blow in on the coast farther north, are replaced

in California by the trade-winds which blow out from the land. Though the western slopes of the mountains have heavy rains, the eastern slopes and the intervening plateaus are very dry, and large areas are deserts.

Owing to the moderating influence of the ocean, the temperature along the coast is cool in summer and mild in winter. On the interior plateau, especially in the lower parts, the summers are very hot, the desert region in Arizona and New Mexico being one of the hottest areas in the world at this season (Map 11 in Atlas, Fig. 162). In the higher parts of the mountains the temperature is lower, and some of the loftier peaks are covered with snow even in summer.

Sec. 367. Agriculture.—On account of the mountainous character of the surface and the desert dryness in many regions, only a small part of this division is cultivated. Many valleys are partly filled with sediment, which has been washed down from the mountain sides, and where these valley-plains can be irrigated, abundant crops are grown. The Mormons, a religious sect, have literally "made the desert to blossom like the rose" in Utah, near Salt Lake City. But the most remarkable farming district in the whole United States is the valley between the Coast Mountains and the Sierra Nevada of Southern California. As the result of irrigation, not only have the farmers been able to raise wheat, barley, and maize, but owing to the semi-tropical temperature, immense quantities of oranges, lemons, raisins, prunes, almonds, and olives (Fig. 163). Besides these tropical and semi-tropical fruits, almost all the early peaches, pears, plums, cherries, and grapes sold in Canada come from California. In western Washington and Oregon is one of the most important wheat-producing areas in the United States (Fig. 157).

Sec. 368. Ranching.—Throughout many of the arid regions which are not absolute deserts, tufts of grass grow out of the sand and form pasturage for large flocks of sheep and cattle.

Sec. 369. Mining.—It was the discovery of gold in California that first attracted settlers from the Eastern United States across the high mountains and wide deserts towards the Pacific coast, and mining has been the most important industry ever since. Wherever a valuable vein of ore is discovered, a mining town grows up like a mushroom, and as the mines of the district become exhausted, the towns diminish in size and often become entirely forsaken. Gold, silver, copper, lead, zinc, coal, and petroleum are all widely distributed. Two of the most wonderful gold mines in the world were the *Comstock Lode* at *Virginia City*, Nevada, and the mine at *Cripple Creek*, Colorado. One of the greatest copper mines in the world is at *Butte* in Western Montana, and Arizona also produces

[Courtesy of Professor D. T. MacDougal, Director Carnegie Desert Laboratory, Tucson, Arizona.

FIG. 162. WATER-HOLE IN THE DESERT

What is the nature of the vegetation? What do you suppose is the source of water? What are the two men doing? **Find the man's hat and gun!**

[*Courtesy of Citrus Fruit Growers' Association, California.*

FIG. 163. ORANGE TREES AND PERPETUAL SNOW IN THE SAME PICTURE!

Oranges grow in the California Valley, and a few miles away tower the snow-capped peaks of the Sierra Nevadas. Notice the orange groves in the level valley.

[*Courtesy of Chicago, Milwaukee, and St. Paul Railway.*

FIG. 164. BIG TREES IN ONE OF THE UNITED STATES NATIONAL PARKS IN THE CASCADE MOUNTAINS

What is the diameter of the tree to the right? (Compare it with the automobile.) How close together are the three large trees? From this picture one can judge as to the quantity of lumber to be obtained from an acre.

[*Courtesy of Chicago, Milwaukee and St. Paul Railway.*

FIG. 165. A PART OF SEATTLE

What is the name of the body of water? Notice the many modern "sky-scrapers."

large quantities of this metal. *Denver*, at an altitude of one mile in Colorado, is in the midst of a great mining district, and much of the mineral is smelted and refined in this city.

Sec. 370. Lumbering.—Along the western slopes of both the Coast Range and the Sierra Nevada as far south as Central California grow dense forests of giant trees resembling those of British Columbia, and there are very large saw-mills around *Puget Sound* (Fig. 164).

Sec. 371. Fishing.—The salmon enter the rivers of the Pacific coast of the United States much as they do those of British Columbia, and the catching and canning of salmon is a very important industry along the Columbia River and on the shores of Puget Sound.

Sec. 372. Cities.—There are no great cities in the interior plateau. This is due to the relatively small production and the scattered population. Mines are usually scattered, and each has its own adjacent village or small town, but there is little manufacturing in such uncongenial regions. On the coast, however, where lumbering, fishing, and farming employ large numbers of people, there are several important commercial cities. *San Francisco*, on the only important bay along the whole American Pacific coast, has a magnificent harbour, and is the shipping centre for the whole southern part of the Cordillera. It has extensive trade with South America, Australia, and Asia. *Los Angeles*, in Southern California, is the chief centre of the trade in tropical fruits and is famous as a residential city and as the centre for making moving-picture films. *Seattle* (Fig. 165) and *Portland*, on Columbia River, are growing rapidly and are obtaining much of the trade which formerly went to San Francisco. Seattle has also developed a large trade with Alaska and British Columbia. Both cities have large saw-mills.

Alaska

Sec. 373.—To the north-west of the Dominion of Canada lies Alaska, which belongs to the United States. The mountains of Canada are continued into it, and one of the Alaska ranges contains the highest peak in North America, *Mount McKinley*, which is 20,464 feet high. The climate of Alaska is so cold that the mountains are covered with snow both in summer and winter, and many glaciers come right down to the coast.

Sec. 374. Industries.—The most important industry is fishing. Salmon enter all the rivers emptying into the Pacific Ocean, in even greater numbers than in British Columbia. They are canned in Alaska and brought by ship to Seattle. Whale-fishing in the

[*Courtesy of Chicago, Milwaukee, and St. Paul Railway.*

FIG. 166. SITKA, A COASTAL VILLAGE OF ALASKA

Notice the low, narrow coastal plain backed by snow-covered mountains.

Pacific Ocean is carried on from bases in Alaska, while the fur-seal fishing, formerly conducted throughout the Northern Pacific, has greatly diminished, and is centred in Alaska.

In 1899, the discovery of gold along the *Klondike Creek*, a branch of the Yukon River, caused a rush of people to Alaska and the Canadian Yukon as great as the similar rush to California half a century earlier. Much gold is mined in Alaska, and there are vast quantities of coal and copper, which will be developed as the region becomes more accessible.

Lumbering will also be an important industry of the future, and there are extensive grass lands, which will undoubtedly be used for the raising of cattle. Even farming is a possibility in some of the fertile valleys close to the coast, where the westerly breezes from the Pacific Ocean moderate the climate. *Juneau*, the capital, in the south, is the most important port, but there are no large cities. *Sitka* was formerly a town of some importance (Fig. 166).

CHAPTER XXV

MEXICO, CENTRAL AMERICAN STATES AND THE WEST INDIES

Mexico

Sec. 375.—The Republic of Mexico, which is situated south of the United States, has the Gulf of Mexico and the Caribbean Sea on the east and the Pacific Ocean on the west. It is composed of two peninsulas connected by the *Isthmus of Tehuantepec*. The northern peninsula is largely occupied by a high plateau, with coastal plains on the east and west (Fig. 167).

FIG. 167. THE AREA OF MEXICO (IN BLACK) COMPARED WITH THAT OF THE FOUR WESTERN PROVINCES OF CANADA

On account of the gradual rise from the coastal plain to a relatively high plateau Mexico has a variety of climates. Along the coast the temperature is high throughout the year, the difference between summer and winter being less than ten degrees. Halfway up on the plateau is a land of perpetual spring; and on the top of the plateau the climate is cool in winter but becomes very hot during the summer. Throughout Mexico the seasonal division is not into summer and winter, but rather into a wet

season from June to October, and a drier season from October to June (Maps 3 and 4 in Atlas). The rainfall is heaviest in the south and decreases steadily toward the northern part, the plateau region of which is arid.

Sec. 376. The productions of Mexico are remarkably varied for such a small country. This is largely due to the great range of climate, from the hot tropical kind on the lowlands to the temperate on the plateau. On the warm coastal plain, sugar-cane, tobacco, cacao trees, and vanilla are the leading products; on the belt between the coastal plain and the plateau corn is the most important agricultural product of the region and the chief food of the people. Coffee is also a characteristic crop of this region. On the plateau wheat and cotton are largely grown where there is sufficient moisture, and cattle and sheep graze on the drier parts.

Sec. 377. Minerals.—It was the mineral wealth of Mexico that first attracted Europeans, and mining is still a very important industry. In the mining of silver this country is only surpassed by the United States, and it stands third among the nations in the mining of copper. Gold, iron, and petroleum are also mined, the last in very great quantities.

Sec. 378. The people, who are almost twice as numerous as the people of Canada, can be divided into three classes, the Spaniards, the native Indians, and the mixed bloods, the two latter classes being the more numerous. The Indians, who in other parts of North America have never taken a prominent place in civic and political affairs, have in Mexico shown high intellectual powers and have held the highest offices in the republic, including that of president.

Sec. 379. Cities.—In temperate climates the cities are usually situated in the lowlands, but in Mexico, on account of the intense heat and unhealthiness of the coastal plains, most of the cities are either on the plateau or on the slope between the central highlands and the coastal lowlands. *Mexico*, the capital, which is a city of about the same size as Montreal, is situated on the plateau in a hollow basin, with the snow-capped volcano, *Popocatepetl*, rising high in the south-east. It is connected by railway with the ports of *Acapulco* on the Pacific coast and with *Vera Cruz* on the Gulf of Mexico.

Central America

Sec. 380.—Central America is not a single political division, but is divided into four independent republics, the government of which is rendered unsettled by frequent revolutions. The largest of these republics is the Central American Union, recently

formed by the union of three small states. The surface and climate are very similar to those of Southern Mexico, though the climate is generally hotter and the rainy season longer. Coffee, bananas, cocoa-nuts, and corn are important products. Both soil and climate are so admirably adapted to promote growth that four crops of corn are sometimes produced in a single year. The people are quite similar to those of Mexico.

The Panama Canal

Sec. 381.—After the repeated failure of other nations, the United States has succeeded in constructing a canal across the Isthmus of Panama (Map 25 in Atlas). This canal is about thirty-five miles long, three hundred feet wide in the narrowest part, and over forty feet deep, and it will prove in many ways a great aid to commerce. It has shortened by six thousand miles the sea journey to Europe from British Columbia and the western ports of the United States, and has also brought the Pacific coast of South America nearer to Europe by four thousand miles. It was necessary, formerly, in both cases to double Cape Horn in South America. Moreover, the Panama Canal makes it possible to ship many of the products of Western Canada and of the Western United States to Europe from Pacific ports, thus avoiding the longer railway haulage to the Atlantic coast.

The West Indies

Sec. 382.—Between North and South America lies a group of islands called the West Indies. These are divided into three groups (Map 8 in Atlas): the *Bahamas* to the east of Florida; the *Greater Antilles*, consisting of the four largest islands, *Cuba*, *Haiti*, *Porto Rico*, and *Jamaica*; and the *Lesser Antilles* to the east, consisting of many small islands.

Sec. 383. The climate throughout the group is tropical, and there is abundant rainfall (Maps 10, 11, and 12 in Atlas). The products are sugar-cane, tobacco, coffee, cocoa, bananas, cocoa-nuts, oranges, limes, pepper, and sisal hemp. Soon after these islands were discovered by Columbus, the natives were killed off by Europeans. When Spaniards settled in the islands, negro slaves were brought to work on the plantations. And as soon as their emancipation made labour harder to procure, Chinese and natives of British India were brought into the country to assist in cultivating the soil. Consequently, the present inhabitants are composed of Spaniards, negroes, mixed bloods of all degrees, Chinese, and Indians.

[*Courtesy of Canadian National Railways.*

FIG. 168. A SHIP BELONGING TO THE CANADIAN GOVERNMENT MERCHANT MARINE UNLOADING CANADIAN GOODS AT KINGSTON, JAMAICA

What articles are being unloaded? To what race do the labourers belong?

Sec. 384. The Bahamas, unlike the remainder of the West Indies, are coral islands. All are British territory. Besides sisal hemp and pineapples, large numbers of sponges are exported.

Sec. 385. Cuba, the largest of the West Indies, is a republic under the protection of the United States. Its population is about equal to that of the Province of Quebec. *Havana,* the capital, and the only large city in the West Indies, has a population one-half as large as that of Montreal. Though tobacco and sugar-cane are the staple productions of the island, large quantities of coffee, cocoa, bananas, pineapples, iron, and copper are also exported.

Sec. 386. Jamaica, the largest of the British islands, exports bananas, cocoa-nuts, sugar, cocoa, and logwood dye. The latter, which is obtained from the wood of the logwood tree, is the most valuable export (Fig. 168).

Sec. 387. Haiti is divided into two independent republics, and since it is in a chronic state of unrest and insurrection, its natural fertility has not been fully exploited. Coffee of excellent quality is the chief product, and cocoa, cotton, and tobacco are being grown in increasing quantities.

Sec. 388. Porto Rico, which was ceded by Spain to the United States in 1898, is one of the most prosperous of the West Indies. It has the usual products: sugar, cotton, coffee, tobacco, oranges, pineapples, and grape-fruit.

Sec. 389. The Lesser Antilles are composed of a large number of islands which are owned by Britain, France, Holland, and the United States. France holds two, Holland five (none of which are important), the United States three, which she recently purchased from Denmark, and Britain owns all of the others. *Barbados,* and *Trinidad,* noted for its lake of asphalt, are the two most important of the British islands in the Lesser Antilles.

Bermudas supply the New York market with

CHAPTER XXVI

SOUTH AMERICA

Project

Sec. 390. To study the relation between the climate and vegetation of South America.—What countries of South America lie between the tropics? (Map 26 in Atlas.) What fraction of the whole continent is within the tropics? What fraction of North America is within the tropics? Which of the two continents has the warmer climate? What part of Canada is in the same latitude as Tierra del Fuego? What region in South America is hottest in January? (Map 28 in Atlas.) Will this be a low or high pressure area? (Sec. 34.) Will the winds blow toward or from this low pressure area? (Sec. 34.) Will the air be ascending or descending in this area? (Sec. 33.) Explain why this area will have heavy rains at this season. In January what part of South America does the south-east trade-wind strike? (Map 3 in Atlas.) Why does it produce rain in that part of South America? What winds blow up the Amazon at this season? Explain why in January there are heavy rains in the Amazon basin. What impedes the north-east trade-winds as they blow over Venezuela? (Map 26 in Atlas.) Why is the basin of the Orinoco River rainless in January? Which is the hottest region in South America in July? (Map 29 in Atlas.) Explain why at this season there are heavy rains in the basins of the Orinoco, and of the Amazon (Sec. 38). Why is Southern Brazil almost rainless at this season? In what direction do the winds on the Pacific Ocean blow, south of forty degrees? Explain why they bring rain to the west side of the Andes and leave the region east of the Andes dry (Map 30 in Atlas). In what direction do the winds on the Pacific Coast blow, north of forty degrees? Will they become warmer or colder as they approach the Equator? Will they be drying or rain-producing winds? Study Map 31 in the Atlas, and from the facts learned about the rainfall explain the deserts of the Pacific Coast and of Southern Argentina, the llanos of Venezuela, the selvas of the Amazon Valley, the pampas of Argentina, and the forests of Southern Chile.

Sec. 391. Position and size.—South America is situated much farther east than North America. Indeed, the meridian passing

through Florida has the whole continent of South America to the east of it. So far east is this continent that the cities of Brazil and Argentina are as near to Southern Europe as they are to the City of New York.

This continent is even more nearly triangular in shape than is North America and like the latter continent has the broad part of the triangle to the north. Its area, though considerably less than that of North America, is about twice as great as that of Canada or Europe.

Sec. 392. Coast.—In strong contrast with that of North America, the coast of South America is very regular. Not one large gulf or bay extends into the land, not a single peninsula stretches out into the ocean, and no large island is found adjacent to the land. These conditions all indicate that the coastal regions of the greater part of South America have been recently elevated (Sec. 128). The only part that has recently been depressed is that bordering on the Pacific Ocean from thirty-two degrees south to *Tierra del Fuego*. Consequently, there are in this region many fiord-like inlets bordered by numerous islands. Besides these islands, which are situated near the coast, there are several groups which have long been separated from the mainland. The *Falkland Islands*, which belong to Britain, are three hundred miles east of Tierra del Fuego: *Juan Fernandez*, a group of volcanic islands, one of which is supposed to be Robinson Crusoe's Island, is nearly four hundred miles west of Chile; and the *Galapagos Islands*, another volcanic group, situated on the Equator, are nearly six hundred miles west of Ecuador. Among all the capes of the world there is none more notable than *Cape Horn* at the extreme southern point of this continent. As the winds blow strong and the seas roll high in this region, the rounding of Cape Horn was considered to be a notable achievement in the days of the sailing vessel.

Sec. 393. Divisions and peoples.—When South America was first discovered it was inhabited by Indians, some of whom were partially civilised. Of the European nations, Spaniards and Portuguese were most active in exploring its wildernesses. By a decision of the Pope, the western part was made the special province of Spanish exploration, and the eastern of Portuguese. So we find that in the countries along the Andes Mountains, Spaniards are the dominant European people and Spanish is the chief language, while in Brazil the Portuguese language is spoken. There has, however, been no such immigration of Europeans into South America as into North America, and the native Indians are most numerous in all the Andean countries, including Venezuela, but excluding Chile. The eastern countries, which are more accessible to Europe, are occupied chiefly by the peoples of South Europe;

Brazil by Portuguese and Italians, and Argentina, whose climate seems specially adapted for Southern European settlement, by Italians and Spaniards.

The total population of the continent is a little greater than that of Great Britain.

Most of the countries were formerly colonies of Spain and Portugal, but with the exception of the Guianas all are now independent republics. *Venezuela*, *Colombia*, *Ecuador*, *Peru*, and *Bolivia* are all more or less backward, inhabited largely by Indians, and unsettled in government. Perhaps on account of its more suitable climate *Chile* has attracted a larger number of Europeans, and is more progressive. *Brazil* is the largest country in South America, while in the western hemisphere it is only surpassed in size by Canada and the United States. *Argentina*, the second country in size, is the most progressive in South America, and within recent years has developed wonderfully—it is the Canada of South America. *Paraguay*, a small pastoral state between Brazil and Argentina, is much more backward than its larger neighbours. Its population comprises chiefly Indians, who have not mixed to any great extent with Spanish and Portuguese. The small state of Uruguay is much more progressive and resembles Argentina in its people and industries. The *Guianas*, east of Venezuela, are colonies of Britain, Holland, and France, called respectively *British Guiana*, *Dutch Guiana*, and *French Guiana*.

Sec. 394. Surface.—The general structure of South America closely resembles that of North America. Through the whole western portion runs a massive plateau, called the *Andes Mountains* (Map 26 in Atlas). On the east are the *Brazilian Highlands*, corresponding to the Appalachian Highlands in North America, and along the north are the *Highlands of Guiana*, corresponding to the Canadian Shield. Between the Andes Mountains and the Brazilian Highlands lies a great plain, which extends from the Highlands of Guiana to the southern point of the continent.

The Andes Mountains are of recent origin, and in many parts they are still being gradually elevated. Many volcanic cones occur, and at the present time active volcanoes are quite numerous. These mountains are broadest and most massive toward the centre of the continent in Bolivia, though the highest peak, *Aconcagua*, is found farther south in Argentina. The Andes consist of several parallel ranges. In the south the coastal range forms a series of islands, and throughout northern Chile, Peru, and Ecuador it can be traced more or less distinctly near the coast, with a valley between it and the main range of the Andes. In the north the Andes divides into three branches, the most easterly of which extends along the north of Venezuela as far as the island

[Courtesy of Buenos Aires and Pacific Railway.

FIG. 1160. THE PEACE MONUMENT PLACED AT THE CREST OF THE ANDES MOUNTAINS, ON THE BOUNDARY BETWEEN ARGENTINA AND CHILE

It represents Christ standing on the globe, on the boundary between the two countries, with a cross in His left hand, while His right points toward Heaven. This statue is placed on a spot above the line of vegetation and without house or building of any kind for miles around.

of Trinidad. The other two branches lie one on each side of the *Magdalena River*.

The Brazilian Highlands are more ancient than the Andes, consequently they are much broken and more deeply eroded, while the rivers cut through them in deep canyons. They are highest near the eastern side and slope gradually inward.

The great central plain forms the valley of the three largest rivers of the continent: the *Orinoco* in the north, the *Amazon* in Brazil, and the Rivers *Plate* and *Parana* in the south. The Orinoco drains the valley lying between the Highlands of Guiana and the eastern branch of the Northern Andes. It is a fine stream, fifteen hundred miles long, and navigable for the greater part of its course. During the wet season it is a rushing torrent, and its level may rise as high as fifty feet. Consequently both the main river and many of its tributaries overflow their banks. In the north its valley is low and flat and presents a remarkable contrast in the dry and rainy season. During the summer the heavy rains make it a jungle of tall grasses, but during the winter the ground becomes parched, the grass withers, and it is a land of desolation. The region is called the *llanos of the Orinoco* (Map 31 in Atlas). South of the river the rising land receives both summer and winter rains and is well wooded. The whole region is thinly settled, and many parts have never been explored.

The Amazon River in Northern Brazil is the mightiest in the world. The distance from its source in the Andes Mountains to its mouth in the Southern Atlantic Ocean is four thousand miles. Not only does it drain the largest area of any river, but owing to the heavy rainfall in its basin, the water which passes along its course far surpasses that of any other stream in the world. It is navigable for the largest ocean steamers to *Iquitos*, two thousand miles from its mouth, and for good-sized steamers to the foot of the Andes Mountains. The main river has an average depth of 120 feet and a width of from two to seven miles during the dry season. When the river is in flood, it spreads out for many miles over the low bordering plain, covering hundreds of thousands of square miles and drowning the dense forests bordering its banks, so that only the tops of the trees project above the water. The Amazon is not a single stream, but for thousands of miles is composed of a network of channels braided in the most complex manner. Indeed, it is possible to sail up the Amazon for a thousand miles without once entering the main channel. It has at least fourteen tributaries, each of which in any other part of the world would be considered a great river.

In the south is the extensive river system of the *Rio de la Plata*, which consists of a shallow estuary, called the Plate River or the

Rio de la Plata, and two rivers, the *Parana* and *Uruguay*, which empty into it at the same point. This system of rivers probably carries down a greater volume of water than the Mississippi. Since the region which it drains is hemmed in by the Andes, the Brazilian Highlands, and the impassable forests of the Amazon on three sides, it is bound, as the only outlet for such a vast region, to become one of the greatest water routes in the world.

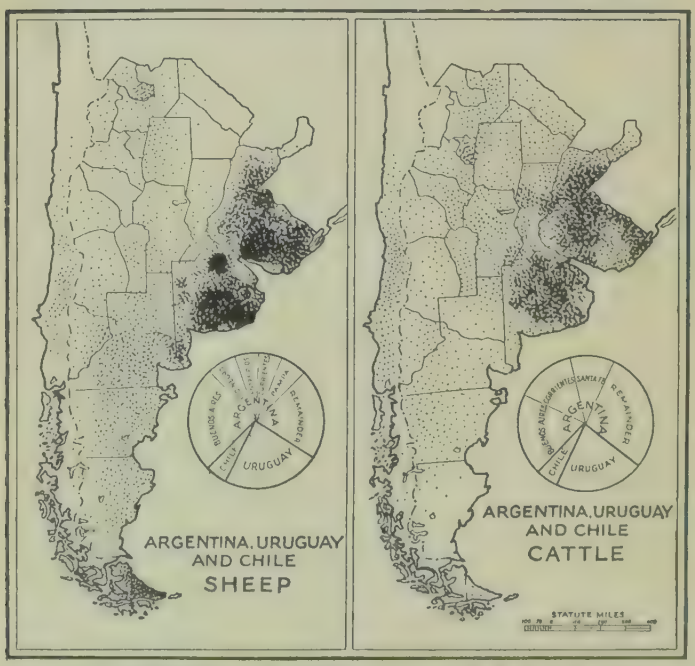


FIG. 170. DISTRIBUTION OF SHEEP AND CATTLE IN SOUTH AMERICA

The rivers are navigable for long distances (Map 27 in Atlas), but not continuously, as frequent cataracts bar the way. Unfortunately, even the Plate River is shallow and has required much dredging to make a moderately deep channel to Buenos Aires.

Sec. 395. Climate. As a very large part of South America lies within the tropics, and its most southern point is far from the Antarctic circle, there are no extremes of climate, such as are found in North America. The tropical lowlands are hot (Maps 28 and 29 in Atlas). In the tropical Andes all degrees of tempera

ture, from the hottest and most depressing climate of the low plains to the almost arctic coldness of the higher plateaux, are experienced. In Venezuela, Colombia, and Ecuador, where such contrasting climates are met, the chief part of the population is found in the moderately high regions, where the temperature is not too depressing. In the south the continent is so narrow that the moderating influence of the ocean is felt right across, and the extreme continental climate (Sec. 49) of the middle portions of Central Canada and the United States is unknown. Even the climate of Tierra del Fuego is not so bleak as it was formerly pictured, and some of the most successful sheep ranches in Argentina are to be found in this region (Fig. 170). The cold Peruvian current flows north along the Pacific coast from Southern Chile to Colombia (Map 7 in Atlas) and causes the lowlands in those regions to be relatively cool.

During the southern summer (December to February) the central and southern part of Brazil is the hottest part of South America (Map 28 in Atlas). This makes the area a region of low pressure, toward which the winds blow, and over which there is a strong ascending current of air, The ascending air cools, and copious rain falls ; or, to put it in another way, we may consider that the doldrums (Sec. 38) bend to the south over this region and cause heavy rains. Farther north over the llanos of the Orinoco at this season, the north-east trades are cut off by the branch of the Andes which skirts the northern coast of Venezuela, and this region has a dry season (Map 3 in Atlas). During the southern winter (June to August) the doldrums are now over the llanos of Venezuela, and this region is drenched with daily rains (Map 4 in Atlas). Farther south in Brazil the south-east trade-winds blow against the Brazilian Highlands and produce a heavy rainfall along the coast, but beyond the highlands in Central Brazil the climate is dry (Map 4 in Atlas). Along the northern part of the Amazon valley, however, where there are no coastal highlands to bar the way, the north-east trade-wind causes a moderate precipitation.

On the Pacific coast there is abundant rain along the north and south, but the central part is rainless and barren (Map 30 in Atlas). The southern part is under the influence of the westerlies, which blow in from the ocean, and, as they ascend the Andes, cause a heavy precipitation. When these same winds descend to the plains of Argentina, like the Chinook of Alberta, they are drying winds. Along the central part of the Pacific coast the winds blow from south to north parallel with the coast. Since they blow toward the Equator, they steadily become warmer and lick up every particle of moisture. Beyond the Equator they are deflected towards the Andes of Colombia and cause heavy rains.

Sec. 396. Vegetation.—The Amazon valley, with its heavy winter and summer rains, is an impenetrable tangle of trees, vines, and climbers (Map 31 in Atlas). The varieties of trees in a Brazilian tropical forest are very great. The density of the vegetation and the rapidity of its growth in this region make it difficult to clear the land and still more difficult to keep it cleared. On account of its forests this region is called the selvas. Farther south, where the rainfall is less, the forests become less dense, and in Southern Brazil are replaced by grassy plains. These are continued through Argentina and are called pampas. They correspond to the prairies of Western Canada.

On the Pacific coast the Colombia lowlands are covered with dense tropical forests. Southern Chile, which has abundant rains, is also a dense forest. The intervening region is a desert.

Sec. 397. Animals.—The native animals are not of great geographical importance. Monkeys are abundant in the tropical forests. Brilliantly coloured parrots, toucans, and other birds are found in the same region. The most important of the animals are the llama, alpaca, and vicuña found in the Andes mountains. The first two are domesticated, and the llama, being sure-footed, is very valuable as a beast of burden in the mountains. The wool of the alpaca and vicuña is used for spinning and weaving into cloth. A variety of ostrich is found on the plains of Southern Argentina.

The Andean States

Sec. 398.—Venezuela, Colombia, and Ecuador, like Mexico and Central America, have hot lowlands in which tropical products such as cacao, sugar-cane, and cotton are grown; a semi-tropical region at a higher altitude in which coffee and corn are the chief crops; and a still higher region with a temperate climate in which wheat and other cereals are cultivated, and cattle, sheep, and goats are raised. Rubber is obtained from the forests and is also cultivated in plantations.

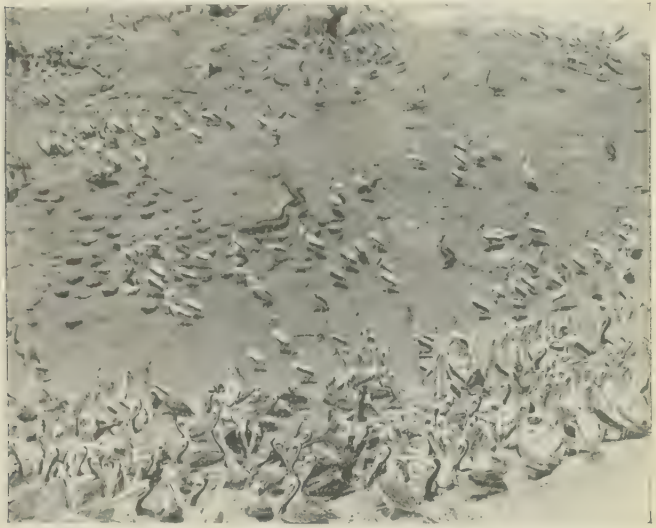
Venezuela is, next to Brazil, the greatest producer of coffee in the world. Its other chief exports are cacao and rubber. Its capital and chief city is *Caracas*.

Colombia also exports coffee, a little cacao, has made a good beginning with the growth of bananas, and mines almost the whole of the world's supply of emeralds. *Bogotá*, the capital, is situated in the Andean Highlands, and is most readily reached from the Orinoco or Magdalena River.

Ecuador's chief contributions to the world's commerce consist of cacao and Panama hats. In the supply of both these commodities

she leads the world. *Quito*, the capital, which is situated in the highlands on the Equator, is connected with the coast by a railway.

Sec. 399. Peru has the same three climatic regions as the countries just described, but in this country the greater part of the population live in the lowlands, not in the highlands as in Colombia and Venezuela. Though the lowlands are dry, by means of irrigation they produce sugar, the most important commodity of



[*Courtesy of Dr. Robert C. Murphy of the American Museum of Natural History.*

FIG. 171. PELICANS NESTING ON A BARREN ISLAND OFF THE COAST OF PERU

Their dung rapidly accumulates as there is no rain. It is a valuable fertilizer, which is exported in large quantities.

the country, cotton, and coffee. The wool of the alpaca, llama, and vicuña, as well as cinchona and coca, from which are obtained quinine and cocaine respectively, are the most important exports from the higher lands. Guano, the dung of sea-birds, is obtained from islands off the coast and is a valuable export (Fig. 171). *Lima*, the capital and largest city, which is inland, is connected by railway with its port, *Callao*.

Sec. 400. Bolivia is one of the most backward of the countries of South America. It is entirely cut off from the sea, and its means

of communication, like those of most of the South American countries, are very bad. In the highlands cereals are raised, and the wool of the vicuña, llama, and alpaca is obtained, but the chief industry of this part is mining. From Bolivia is obtained one-fourth of the world's supply of tin, and large quantities of a mineral, named antimony, which is valuable to make alloys with other metals. To the east of the highlands large quantities of rubber are obtained. *La Paz*, the capital, is situated in the highlands near *Titicaca*, the largest lake on the continent.

FIG. 172. THE AREA OF BRAZIL (IN BLACK) COMPARED WITH THAT OF CANADA (STIPPLED)

Sec. 401. Chile is much more developed than any other country on the west coast. This is partly due to the fact that the population is largely of European origin. The country is divided into a northern arid region, a central agricultural region, and a southern forest and grazing region. In the northern desert are found beds of Chile saltpetre or nitrate, which is the chief source of wealth of the country. This mineral is shipped to Europe, where it is used as a fertilizer and also for making explosives. Over four per cent. of the world's copper is mined in this state. In the central agricultural region, where the chief rains fall in the winter (June to August), irrigation is necessary, and cereals and temperate fruits are produced, while large quantities of wine are manufactured. In

the southern region sheep-raising takes the first place (Fig. 170), and, as has been already stated, is carried on most extensively in Tierra del Fuego. The wool and mutton from the latter region are shipped from *Punta Arenas*, the most southern town in the world. *Santiago*, the capital, is the largest city on the Pacific coast of South America. It is situated on a high plain, and is connected by rail with its port *Valparaiso*. This latter port is the Pacific terminus of the *Trans-Andean Railway*, the Atlantic terminus being Buenos Aires.

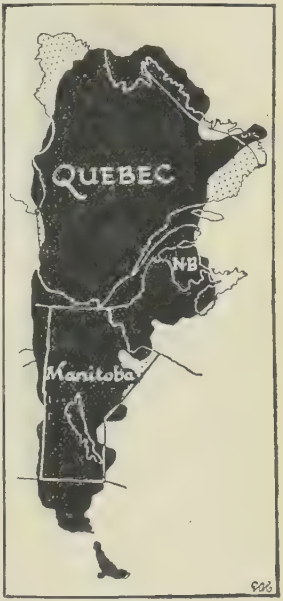


FIG. 173. ARGENTINA COMPARED WITH QUEBEC, NEW BRUNSWICK, AND MANITOBA

Sec. 402. The Guiana Colonies include British, Dutch, and French Guiana. The coastal plain of Guiana recedes to the highlands of the south. The chief productions of British Guiana are sugar, rum, rice, and gold. In Dutch and French Guiana the chief industry is gold mining.

Sec. 403. Brazil is the largest country in South America (Fig. 172), but the population is largely confined to the states bordering the Atlantic coast. In the Valley of the Amazon, though the climate is not excessively hot, there are few settlements and no cleared land. The scattered bands of Indians collect rubber from the forest trees, which is brought down the Amazon and shipped from *Pará* or *Belem*. Along the Atlantic coast, besides Portuguese, there are many Germans, Italians, and Russians. In the State of *São Paulo*, and surrounding regions, is grown four-fifths of the world's supply of coffee. The city of *São Paulo*, almost as large as Toronto, is in the centre of the coffee industry. Sugar-cane, cacao, and cotton are also largely grown along the Atlantic coast (Figs. 66 and 72). In the south-east of the country there is much forest and grass-land, and a kind of tea is grown. The chief city and capital of Brazil is *Rio de Janeiro*, with a population of almost one million. Its magnificent harbour and location at the centre of the most thickly populated part of the state make it the commercial centre of the country both for exports and imports. Cotton weaving, recently, has

[*Courtesy of Buenos Aires and Pacific Railway*,

FIG. 174. CONGRESS HALL (PARLIAMENT BUILDINGS) AT BUENOS AIRES

developed wonderfully, and the manufacture of tobacco, flour, and many other commodities is centred in Rio, as it is usually called.

Sec. 404. Argentina is the most progressive of all the countries of South America (Fig. 173). This is partly due to its temperate climate and its large proportion of European settlers. Its climate is especially suitable to South Europeans, and Spaniards and Italians form the bulk of the inhabitants. In the forested region in the north the cutting and shipping of quebracho is the chief industry. This is a timber used for railway building, as well as for the extraction of a substance used for tanning hides. The growing of cereals, flax, cattle, and sheep is the chief industry of the country. The region around the lower courses of the Parana and Plate Rivers is the centre of this industry. Wheat and corn are the chief cereals, and in the production of flax-seed Argentina leads the world. Mutton and wool are shipped to Europe in great quantities, but sheep-raising is being rapidly replaced by the more profitable business of cattle ranching. The country is well supplied with railways, largely constructed by British capital. These lines branch out from the two great shipping ports of *Buenos Aires* and *Rosario*. The former city is not only the largest in South America, but in the southern hemisphere. It is at the head of deep-water navigation on the Rio de la Plata system, which is the only outlet for the vast region between the Brazilian Highlands and the Andes (Fig. 174). When the deepening of the Parana has been carried out as far as Rosario, that city is bound to become of increasing importance.

Sec. 405. Uruguay and Paraguay are very small states. The former is similar to the adjacent parts of Argentina, and has similar industries. *Montevideo*, the capital, is a beautiful city, and one of the cleanest in the world. It is the commercial centre of the state and has a harbour which accommodates large ocean steamers. Paraguay is a backward pastoral state, largely populated by semi-civilised Indians. Its capital is *Asuncion*.

CHAPTER XXVII

EUROPE

Sec. 406. Size and position.—Although, with the exception of Australia, Europe is the smallest of the continents it is the most densely populated and the most important. In it are found almost all the great nations of the world, and from it have gone forth the peoples who have civilized and developed all the other continents. It is only about half as large as North America and of about the same size as Canada. Though it is always considered to be a continent, strictly speaking it is only a great peninsula extending westward from that greater continent, Eurasia, which includes Europe and Asia. To the east of the continent is Asia, to the south are the Mediterranean and Black Seas, and to the north and west are the Atlantic and Arctic Oceans (Map 32 in Atlas).

Sec. 407. Coast.—One of the factors that has had great influence on the development of Europe is the relatively great extent of coast-line which it possesses. Since the whole north, south, and west coasts are composed of long peninsulas with narrow tongues of water between them, every portion of the continent is close to the sea and experiences the climatic and commercial advantages of such a position. In the north is the shallow *White Sea*, which extends into Russia and brings those distant parts close to an ocean port. Unfortunately, it is free of ice for only seven or eight months of the year. The *Scandinavian Peninsula* on the northwest is almost surrounded by water. Its western coast is a maze of islands and long narrow fiords, gouged out by the ice-caps that covered the whole of Northern Europe during the Glacial Period, in which respect this coast closely resembles that of British Columbia. Between the Scandinavian Peninsula and the mainland lies a succession of navigable waters, the *Skager Rack*, the *Kattegat*, the *Baltic Sea*, and the *Gulf of Bothnia*. As all of these bodies of water, except the more northerly parts of the two latter, are unfrozen throughout the winter, they afford excellent facilities for transportation to a very large part of the interior of Northern Europe. The British Isles are situated on a very wide continental shelf, which lies to the west of Northern Europe (Map 33 in Atlas) and extends far beyond the west coast of Ireland. Between Great Britain and Denmark the continental shelf is covered by the *North Sea*, which is in most parts not more than three hundred

feet deep. This submerged plateau rivals the similar continental shelf on the opposite side of the Atlantic Ocean as a great fishing ground (Sec. 238). In the south are the *Iberian* (Spain and Portugal), *Italian*, and *Balkan Peninsulas*, the two latter being separated by the shallow *Adriatic Sea*.

Sec. 408. Races of Europe.—Though the peoples of almost every country of Europe speak their own language and have their national characteristics, yet the peoples of adjoining countries generally resemble one another so closely in their character and language that the different nationalities can be grouped into a few main races. There are five main classes, the *Teutonic*, *Greco-Italic*, *Slavonic*, *Finno-Tataric*, and *Celtic*. The Teutonic peoples occupy the countries of North-west Europe: Norway, Sweden, Denmark Germany, Holland, part of Belgium, and the United Kingdom. The Greco-Italian peoples occupy the European countries bordering the Mediterranean Sea: Spain, France, Portugal, Italy, and Greece, also Rumania, and the southern part of Belgium. The Slavonic people occupy the most of the countries of Eastern Europe: Russia, Latvia, Lithuania, Poland, Czecho-Slovakia, Ukraine, Jugo-Slavia, and Bulgaria. The Finno-Tataric people are a very ancient stock, who occupy in Europe only Finland, Esthonia, Hungary, and the region in the vicinity of Constantinople. The Celts are also a very ancient people and now are found chiefly in the Highlands of Scotland, Wales, and the western portion of Ireland.

Sec. 409. Surface and drainage.—The chief highlands and lowlands of Europe (Map 33 in Atlas) run from east to west, while those of North and South America run from north to south. Moreover, the plains and plateaus of Europe are not so continuous as in America. The highlands have many gaps, which by allowing easy access from one part to another have played a great rôle in the distribution of the peoples of Europe. Along the north-west runs a very ancient highland, called the *Scandinavian Plateau*, which is composed of granite and volcanic rocks and closely resembles the Canadian Shield both in age and structure (Sec. 203). It forms the backbone of the Scandinavian Peninsula and can be traced to the Highlands of Scotland and the north of Ireland. Probably during an earlier age these discontinuous parts formed one continuous ridge, which is now so deeply eroded that only the roots of the former highlands remain, much of which is covered with water. To the south and east of the Scandinavian Highlands spreads out the great lowland plain of Europe (Map 33 in Atlas). This, which includes Southern Ireland, Southern Scotland, and England, sweeps across the north of France, through Belgium and Holland, widens as it passes eastward through Germany

FIG. 175. DISTRIBUTION OF CATTLE AND HORSES IN EUROPE

Name the countries which raise large numbers of cattle and of horses. Are the cattle more abundant in the wetter or drier parts of the continent? (Map 37 in Atlas.) Which has the wider range, cattle or horses?

and Poland, and expands to occupy the whole of Russia from the Black Sea to the Arctic Ocean. This plain is interrupted by mountains in Wales and by a low plateau in Central Russia. In the east it is traversed from north to south by the *Ural Mountains*, whose slopes are so gradual and whose height so moderate that to the casual observer travelling across the region no mountains would be noticed. This plain is traversed by many of the chief rivers of Europe, which, being navigable, are valuable means of transportation in this the most populous and prosperous part of the continent.

The South of Europe is occupied by highlands made up of plateaux and mountains, which run in a general direction from west to east. In the west the whole interior of the Iberian Peninsula forms an elevated plateau that is bordered on the north by the *Pyrenees Mountains*, which form a natural boundary between France and Spain. The highlands are continued through the South of France and reach their culminating point in the massive *Alps* of Switzerland and Austria. In France occur two of the famous gaps across the highlands, which have played important parts in the history of Europe. One (Map 33 in Atlas) runs from west to east through the valley of the *Garonne River* in the south of France, and the other occupies the valley of the *Rhone River*. Beyond the Alps the plateau is continued as the *Balkan Mountains* to the *Black Sea*, reappears in the Crimea Peninsula to the north of the Black Sea, and is continued beyond this sea as the *Caucasus Mountains*. Through this southern highland another gap of great historic importance is cut by the *Danube River*, along which many armies have found passage during the last thousand years.

Several spurs project south from the main highland, which may be considered the backbone of the continent. One extends through the islands of *Corsica* and *Sardinia*, another, called the *Apennines*, which forms the backbone of Italy, is continued through Sicily and reappears in North Africa, where it swells into the *Atlas Mountains*. Still another extends through the Balkan Peninsula and reappears in the island of Crete.

To the north of this Southern European Highland, and lying between it and the Northern Plain, are the remains of a much older highland, which has been so eroded that it is nowhere high. It includes the broken mountains of Northern France and Southern Germany and the *Carpathian Mountains* to the north of Czecho-Slovakia.

The only extensive plains of the southern region occur along the Danube River. The plain of Hungary lies between the Carpathian Mountains on the north and the Balkans on the south. The plain of Rumania borders the lower course of the same river.

The most extensive plain south of the highlands is the alluvial delta deposited at the mouth of the *River Po* in North Italy. This plain, however, is much smaller than those of Hungary and Rumania.

Since the chief highlands are near the south of the continent, the longest and largest rivers flow across the northern plain. As previously stated, most of these are navigable. The three most notable rivers of Europe, the *Rhine*, *Rhone*, and *Danube*, all rise in or near the Alps. The Rhine in its upper course expands into the beautiful *Lake Constance*, flows north in a deep gorge, which it has cut through the ancient highlands of Germany, then passes across the Great Plain and empties into the North Sea directly opposite the mouth of the Thames. The Rhone and Danube both rise to the north of the main axis of Europe and cut their way through to the south, so that their waters are emptied into the Mediterranean and Black Seas. As would be expected, the wide plain of Russia has long rivers. The *Volga*, the largest in Europe, is over two thousand miles long and has two tributaries larger than the Rhine. Not only is it navigable throughout its course, but it is connected by canals with the Baltic and White Seas. It empties into the *Caspian Sea*.

Sec. 410. **Climate.**—The greater part of Europe lies within the temperate zone, and the remainder is beyond the Arctic circle. The southern part of Spain does not come within fifteen degrees of the tropic of Cancer. Consequently, the continent lies within the belt most favourable for developing a high civilization. The climate of the great lowland in the north is controlled largely by the westerlies, which blow in from the Atlantic Ocean (Maps 3 and 4 in Atlas). Unlike Western America there is no great mountain barrier to prevent these winds from penetrating into the interior and consequently their influence is felt right to the plain of Russia. These winds make the winters of Western Europe very mild even beyond the Arctic circle. But from west to east the winters become more and more severe (Map 35 in Atlas). The same winds make the summers cool (Map 36 in Atlas). In Southern Europe along the borders of the Mediterranean Sea the winters are mild and the summers warm. In the highlands the cold increases with altitude, and the upper peaks of the Alps, Pyrenees, and Sierra Nevada in Spain are perpetually snow capped.

The westerly winds are laden with water vapour, and as they advance over the lands of Northern Europe they deposit their moisture (Maps 3 and 4 in Atlas). The amount of rainfall is greatest in Ireland and gradually decreases the farther inland it penetrates, until in parts of Eastern Russia it is not more than ten inches.

In the Mediterranean countries the westerly winds are felt

COMPARATIVE INTENSITY OF CULTIVATION SHOWN BY DEPTH OF SHADING

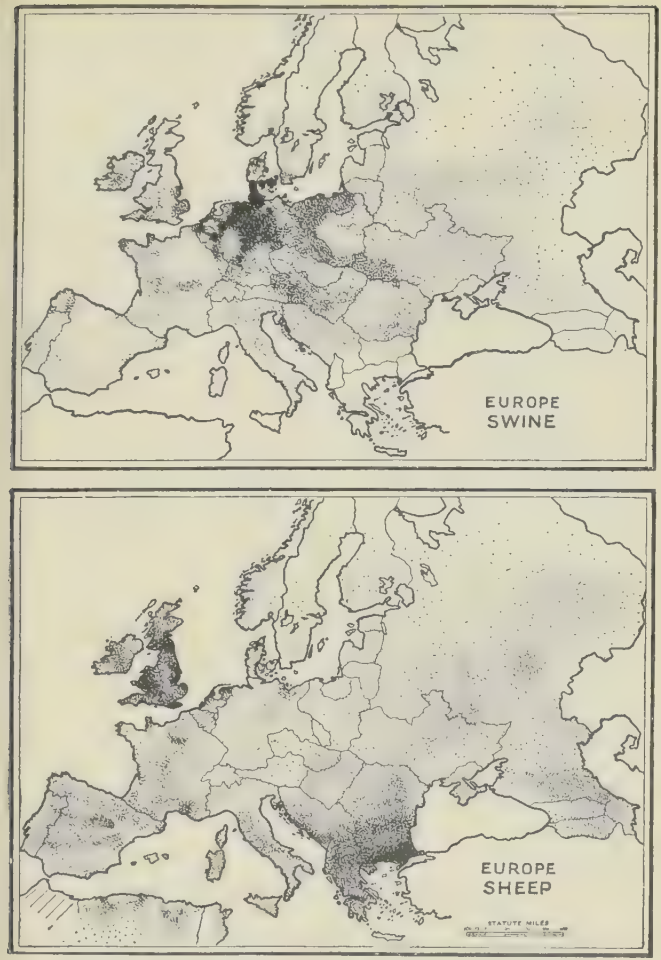


FIG. 176. DISTRIBUTION OF SWINE AND SHEEP IN EUROPE

Name the two countries raising the greatest number of sheep, and the three raising the greatest number of swine.

during the winter and the drying trades during the summer. The former winds bring winter rains but the latter blowing oft the land toward the Equator bring no rain and these countries in the summer are very dry. This condition of winter rains and dry bright summers has been called *Mediterranean climate* because it is so prevalent in this region.

Sec. 411. Vegetation.—Originally almost all of Europe except the higher parts of the Alps and Scandinavian Mountains, the north-eastern and south-eastern part of Russia had sufficient rainfall and warmth to be covered with forest (Map 38 in Atlas). The south-eastern part of Russia, called the *steppes*, is too dry to bear forests and like the Canadian prairies is covered with grass. On the other hand, the north-eastern part, called the *tundras*, is too cold for the growth of forests or even grass.

The forests have to a large extent been cleared and the greater part of the cleared region is now under cultivation (Map 34 in Atlas). It is the greatest food-producing region in the world. On the great lowland plain wheat, rye, oats, barley, potatoes and sugar-beets are the principal crops (Figures 185, 197, and 208). Russia before the Great War led the world in the production of flax and hemp (Fig. 73). In the Mediterranean countries wheat, olives, oranges, lemons, and grapes are largely cultivated (Figs. 76 and 200). The plains of Hungary and Rumania are the chief corn-growing countries of Europe (Fig. 200).

CHAPTER XXVIII

BRITISH ISLES

Sec. 412. Extent.—The whole group of islands lying to the west of the North Sea is called the *British Isles*. This group consists of two large islands and several thousand small ones. The most important island of the group, *Great Britain*, which is also the largest in Europe, consists of three countries, England, Wales, and Scotland. The other large island is called *Ireland*. When the four countries, England, Ireland, Scotland, and Wales were separate, the small islands adjoining each were integral parts of each country. In 1801, when Ireland became politically united to Great Britain, the country was called the *United Kingdom*, and this is the proper title for the country at the present time (Fig. 177).

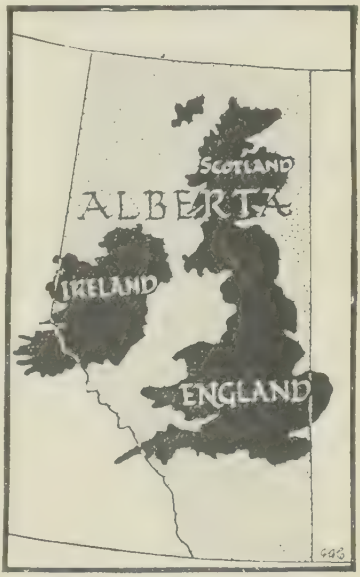


FIG. 177. RELATIVE SIZES OF THE UNITED KINGDOM AND ALBERTA

Sec. 413. The greatness of the United Kingdom.—Although the area of the United Kingdom is much less than that of France, Spain, Sweden, Germany, or Russia, her wealth, her shipping, her trade, and her influence in the world is much greater than that of any of these nations. Moreover, she has founded an empire, which is the largest, wealthiest, most populous, and most diverse that the world has ever seen. It will be necessary to study carefully the geographical conditions that have been instrumental in such a wonderful development. The senior partner, England and Wales, will be studied first, then Scotland and Ireland.

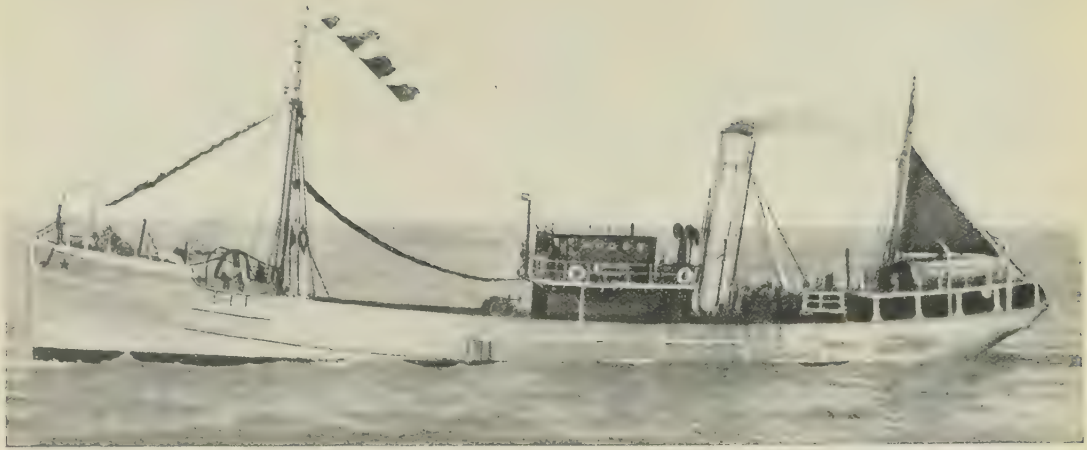
England and Wales

Sec. 414. Location.—Before the discovery of America England was situated on the north-west fringe of the known world, but even then she was on the highway of a good deal of the trade that passed between Northern Europe on the one hand and the Mediterranean countries and the East on the other, for the southern highlands of Europe (Map 33 in Atlas) running from east to west formed a partial barrier to overland trade. The development of America and the opening up of Eastern Asia have so shifted the centre of the world's commerce to the west that England no longer occupies the western fringe but is located at its very centre, and this favourable situation has been an important factor in the development of her greatness.

Sec. 415. Coast.—Great Britain is a long narrow island, no part of which is far from the sea. Moreover, her coastline is indented with many wide estuaries. These are the mouths of rivers, which, though short, are always filled with water on account of the heavy rainfall. Add to this the fact that the tides in these estuaries are high and keep their channels scoured clear of sediment, and we see the reason why the largest ocean steamers can enter them. They thus give to England many excellent harbours and miles of river banks for the construction of wharves. Probably no country in the world has such admirable natural facilities for shipping.

Sec. 416. Fisheries.—As previously stated, the British Isles are situated on a continental shelf (Map 33 in Atlas), over which the water is very shallow. This part of the sea, which extends east across the North Sea, west more than one hundred miles beyond Ireland, and north as far as Iceland, rivals the banks to the east of Canada for the first place as a fishing ground. Most of the fishing boats sail from ports on the east coast, though there is considerable fishing carried on from Devon and Cornwall in the south and from Wales and Lancashire in the west. *Grimsby* at the mouth of the *Humber River* is unrivalled in the world as a fishing town. *Yarmouth* is the centre of the herring fisheries, and at *Billingsgate Market*, London, are sold immense quantities of fresh fish for the London area. The most important fish caught is the herring, though haddock, cod, and plaice are also very valuable. Fishing in England is carried on more scientifically than in Canada. The small motor boat or sailing smack gives place to large steam trawlers and drifters (Fig. 178). The otter-trawl, which has been already described, is extensively used for cod, haddock, plaice, and other bottom fish; but herring and mackerel are taken by drifters (Fig. 179).

Sec. 417. Surface.—The chief highlands of England are found



[Courtesy of The Fish Trades Gazette and Sir Alec Black, Great Grimsby.

FIG. 178. A STEAM TRAWLER

in the north and west (Map 39 in Atlas). The *Pennine Chain* extend north and south through the northern part of England. These mountains are nowhere high, and several gaps are cut through them by the rivers. The Welsh mountains of the west are higher and more rugged. Bordered by these latter mountains on the west and by the Pennine Mountains on the east is the western plain, which extends from north to south throughout the country. The eastern plain, which is more extensive than the western, is narrow to the east of the Pennines but in Middle and Southern England occupies more than half of the width of the country.

Sec. 418. Rivers.—Since England is a very small country the rivers are necessarily short, but they are of immense importance on account of the fact that they are navigable for the largest

[*Courtesy of Smith's Dock Company, Middlesbrough, England.*

FIG. 179. STEAM-DRIFTER SHOOTING HER NETS

A drift-net when out forms a wall of netting about two miles long and thirty feet deep. The net floats vertically in the water. The herring and mackerel are caught by their gills in the nets.

ships and have most of the great harbours of the country along their courses. The *Thames* on the south has the London docks (Fig. 182) for many miles along its banks. The *Severn* rises in the Welsh mountains, flows south, and empties into *Bristol Channel*, a wide estuary. The *Mersey*, which empties into the *Irish Sea*, has Liverpool and Manchester on its banks. The *Humber* with Grimsby and Hull near its mouth, and the *Tyne* with Newcastle, are important rivers emptying into the North Sea.

Sec. 419. Climate.—During the winter the climate is determined by the westerlies blowing in from the Atlantic Ocean, which cause England to be much warmer than are the inland countries of Europe in the same latitude (Maps 35 and 36 in Atlas). Moreover, the temperature is highest on the west side and decreases steadily toward the east. But little snow or ice falls except in the higher parts, and some vegetables, such as cabbage, can be left

[*Courtesy of Cotton Spinners' Association, England.*

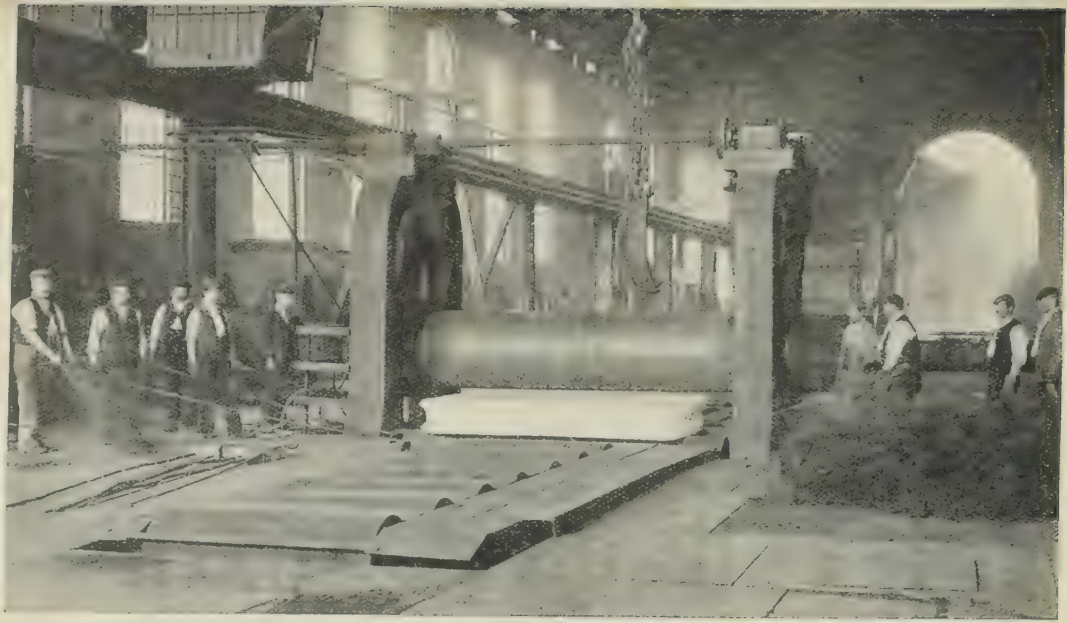
FIG. 180. CARDING ROOM IN A COTTON FACTORY AT OLDHAM, ENGLAND

in the gardens all winter. In summer the influence of the ocean is again marked, and the climate mild. The humid westerly winds blowing against the Welsh mountains and Pennine Chain cause heavy precipitation against their western slopes (Map 37 in Atlas), but the rainfall decreases toward the east and is less than twenty-five inches in the district around London. There are more rainy days and less sunshine in England than in Eastern Canada.

Sec. 420. Agriculture.—Although England grows only a small part of her food supply, agriculture is nevertheless a very important industry. In the Pennines and in Wales, where the soil is poor, sheep-raising is the chief industry. In the western plain, in the Midlands, and in Southern England mixed farming and stock raising are very important (Map 40 in Atlas). As a result of careful selection the English stockmen have developed some of the finest breeds in the world, and many of the choicest varieties both of cattle and sheep take their names from the parts in which they were perfected. The drier eastern part of England is most suitable for the growth of wheat (Map 40 in Atlas), and here they grow almost twice as many bushels to the acre as Ontario or Quebec. Apples, pears, plums, and cherries are grown chiefly in South-east England and north of the mouth of the Severn River. Hops is a product of the same region.

Sec. 421. Mining.—England's mineral wealth consists chiefly of two minerals, coal and iron. But the importance of these and especially of coal cannot be over-estimated, because all the manufacturing districts of England depend on the coal fields. The chief coal fields are in the north and in South Wales (Map 41 in Atlas). In the region around the city of *Newcastle* is the most valuable coal field of the north, and immense quantities are exported from that city. From *Cardiff* on the Severn River, however, is exported more than three times as much coal as from any other English port and more than from any other port in the world. The chief iron mines are found in the north. The Cleveland district in Yorkshire (Map 40 in the Atlas) and the iron fields of Cumberland and North Lancashire are the two most important. The home supply of ore, however, is not nearly sufficient to meet the demands of the iron industry and large quantities of ore are imported from Spain and Sweden.

Sec. 422. Manufacturing.—While agriculture, mining, and fishing are important industries in England, she is above all else an industrial and commercial nation. As her water-power is not great, her source of energy for running machinery is coal, and the position of the coal mines largely determines the position of the manufacturing districts (Map 40 in Atlas). England has many other advantages, which have helped to make her the greatest



[*Courtesy of Vickers, Limited, Sheffield.*

FIG. 181. MILL FOR MAKING ARMOUR PLATE FOR THE SIDES OF THE LARGEST BATTLESHIPS. THE STEEL CAN BE SEEN PASSING BETWEEN THE ROLLERS TO FLATTEN IT

manufacturing nation in the world. Her central position, her admirable harbours, and her supremacy in shipping are of great assistance in the collection of raw materials from all parts of the world and in the distribution of the manufactured goods. Her insular position and strong navy have kept her free from attack for hundreds of years, and her factories have never been destroyed nor her riches exhausted. Consequently, she has long had abundant wealth, which is necessary to build great factories. Further, her large colonial possessions, knit close to her, have furnished abundant raw materials and have supplied an excellent market for her manufactured products. Last but not least, the genius of her people was instrumental in inventing almost all the great machines and processes used in spinning, weaving, and smelting.

Lancashire on the Irish Sea is the centre of the cotton industry (Fig. 180). *Liverpool* and *Manchester* on the Mersey are convenient ports for landing the cotton from the United States. The Lancashire coal fields supply motive power, and the humid air gives the proper adhesiveness to the cotton fibre, so that it can be worked without breaking. Manchester is the greatest cotton emporium in the world, and gathered around it so closely that they are almost continuous are a number of large cities and all are engaged in spinning cotton yarn and weaving cotton cloth (Map 42 in Atlas).

Immediately across the Pennine Mountains in Yorkshire is the centre of the woollen industry (Map 42 in Atlas). *Leeds*, a city about the size of Toronto, is at the centre of the district. Originally the supply of wool came from the flocks of the Pennine Chain, but now that source forms only an insignificant part, Australia, New Zealand, and South Africa furnishing the chief supplies. Farther south, nearly in the centre of the country, is what is called the "black country" on account of the immense quantities of smoke from the chimneys of the factories of *Birmingham* and adjoining towns. This is the centre of the manufacture of iron and steel goods of all kinds (Map 41 in Atlas). An adjoining coal field supplies the fuel, and formerly there was an abundance of iron ore near at hand, but now the iron ore is chiefly imported. *Sheffield*, farther north, a city about the size of Toronto, is chiefly noted for the making of cutlery and fine cutting tools of all kinds (Fig. 181). Coal, iron, water-power, and rock material for the making of grindstones are found in the neighbourhood, and undoubtedly the latter, which is so necessary for putting edges on tools, is partly responsible for the special line of manufacturing developed in this district. In Staffordshire, between Birmingham and Manchester, is a district called the *Potteries*, which is noted for the manufacture of earthenware and porcelain (Map 43 in Atlas). A great variety of clays is found there as well as coal, of

[Courtesy of the Port of London Authority.

FIG. 182. MILLWALL DOCK, LONDON

Handling grain. The small boats are lighters, on to which the cargoes from the large ships are loaded.

which large quantities are used in baking pottery. *Stoke* is the largest town in the region. *Crewe* near by is an important railway centre. *Derby*, east of the potteries, and *Worcester*, south-west of Birmingham, have long been famous for the manufacture of porcelain, and the names of these cities will be found on the bottoms of many of the finest dishes. In South Wales great quantities of coal are used for the smelting of imported ores of iron, tin, zinc, and copper, and immense quantities of tin-plate are manufactured. *Swansea* and *Cardiff* are the most important cities of the region. Formerly along the Thames was the centre of the ship-building industry in which the United Kingdom is supreme, but it has within recent years largely shifted to the north-east coast along the rivers *Tyne*, *Wear*, and *Tees*, where coal and iron are in close proximity.

Sec. 423. Shipping.—The United Kingdom is the greatest trading country in the world, and her exports and imports far surpass those of any other country with the exception of the United States. The imports are chiefly food and raw materials for her manufactures, and the exports are chiefly coal and manufactured products. Not only are the exports and imports carried largely in British ships, but in every sea are found British ships carrying goods to and from foreign ports. Indeed, almost half the ocean traffic of the world was carried in British ships before the Great War, and she is bound to be just as supreme again in a few years. Needless to say, some of the greatest seaports in the world are situated on the British coast.

London, the greatest city in the world, has a population almost equalling that of Canada. Its greatness is due to many causes. The fact that it is situated at the head of the Thames Estuary, by which freight can be brought so far into the interior of the country, was of great advantage. It is also well situated for communication with all parts of the country. Again, the mouth of the Thames is almost directly opposite the mouths of the Scheldt and the Rhine, two rivers that communicate with some of the wealthiest and most populous parts of the continent. This gave London a commanding position for continental trade. These natural advantages led to the city being made the capital of the country, and with the growth of the British Empire its importance greatly increased. It is especially notable for what is called transhipment trade. Much of the tea, coffee, cocoa, and spices required by Europe are first brought to London and from there distributed locally and to the continent (Fig. 182).

London contains some of the most famous buildings in the world. Of churches St. Paul's Cathedral and Westminster Abbey have long been famous. The British Museum, the Zoological Gardens, and the Kew Botanical Gardens are unrivalled in the world.

Buckingham Palace, the residence of the King, and Marlborough House, usually the residence of the Prince of Wales, are two of London's most interesting palaces. There is no more venerable building in the city than the Tower of London, once a fortress on the Thames, but now an armoury and the storehouse of the regalia of England.

Liverpool, near the mouth of the Mersey River, is the third city in the country and the first seaport. Its trade with America is very great. *Southampton*, the chief seaport on the south coast, has a large trade with the West Indies, South America, and South Africa.

Scotland

Sec. 424. Scotland, which occupies the northern part of the island of Great Britain, is only a little more than half as large as England and slightly smaller than Ireland. The northern part, on account of its elevation, is called the *Highlands* (Map 33 in Atlas); the central part, which contains a very large part of the population, is lower and more level. It is called the *Lowlands*. In the southern part the Lowlands become higher again and are called the *Southern Uplands*.

The Highlands, which cover more than half of the whole country, are divided into two parts by a remarkable depression, *Glen More*, which runs from south-west to north-east. The nature of the surface of the Highlands can best be understood by an account of its history. In past ages the surface was a plateau of hard granite. The rivers in time wore valleys in its surface, and in the course of ages the valleys became wider and the high parts between the valleys became narrower and narrower. To-day the mountains, if such they can be called, are the narrow remnants of the old plateau that form the divides between the river basins. These mountains are often flat topped and are not composed of a series of peaks but of a continuous ridge. Moreover, the heights of the mountains are about the same over a considerable area. Since there is a much heavier rainfall on the west side of the country than on the east side (Map 37 in Atlas) and consequently greater erosion in the river valleys, the intervening mountains are broader-topped on the east side than on the west. While in the east the flat tops of the mountains often contain several square miles, on the west the summits become sharp-edged and are often crag-like.

Sec. 425. Industries of the Highlands.—With the most severe climate to be found anywhere in the British Isles and with a rough mountain surface composed of granite like rocks, which on decay form infertile soil, the Highlands are very thinly settled. In some of the river valleys, especially in the east, where sediment has

been deposited in the valleys, there are grain crops of oats and barley (Map 40 in Atlas). Though in the rougher parts many sheep find pasturage, a great deal of this portion of the Highlands has been purchased by wealthy landowners, fenced, and converted into deer forests, which are used for hunting purposes. In fact more of Scotland is given over to deer forests than to cultivation.

The people around the coast combine fishing with farming. But during recent years the small fisherman with his own boat is meeting such keen competition by the large steam trawler and drifter owned by big capitalists, that this method of eking out a living is becoming more difficult.

No valuable minerals are found in the Highlands, and the chief mineral product is granite, which is quarried in large quantities, for Scotch granite is a valuable decorative stone.

Much of the oats and barley grown in the Highlands is converted into liquors in large distilleries scattered over the district.

Since the small population is scattered there are no large cities. *Inverness*, situated at the head of *Moray Firth*, is the most important town and is often called the capital of the Highlands. The wild highland scenery makes it one of the most beautiful towns in Great Britain.

The Lowlands

Sec. 426. The Lowlands, which form the central part of Scotland, contain over three-quarters of the population of the country. There are several reasons why this is the most progressive part of the country. The surface is comparatively low and contains much fertile land, the climate is much milder than in the north, and as there are no highlands crossing the path of the westerlies, the copious rainfall is well distributed from east to west (Map 37 in the Atlas); the wide estuary of the *Firth of Forth* facing continental Europe and the wide estuary of the *Clyde River* facing America give the Lowlands access to the commerce of both continents. Again, since some of the most notable coal fields on the island are found on both the east and west of the Lowlands, and iron mines are found close to the coal (Map 41 in Atlas), conditions are favourable for manufacturing. Above all these natural advantages stand the sturdy, industrious, thrifty character and keen intelligence of the Scottish people as the chief cause of the industrial development of the Scottish Lowlands.

Sec. 427. Farming. –While in the Highlands to the north and in the Uplands to the south the rearing of sheep and cattle are the chief forms of farming, in the Lowlands the production of wheat,

[*Photograph by W. Norrie, Fraserburgh.*

FIG. 183. FLEET OF SCOTTISH HERRING BOATS

oats, and barley and even fruits is combined with these operations (Map 40 in Atlas). In the west, where the rain is most abundant and the grass luxuriant, most of the land forms pasturage for cattle, while in the drier east the less luxuriant grasslands form pasturage for sheep, and here the only wheat in the country is raised.

Sec. 428. Fishing.—With the many estuaries and lochs indenting the coast, harbours abound on both sides, not only of the Lowlands but also of the Highlands, and some excellent fishing grounds are found both east and west. Consequently in all the seas around Scotland many people are engaged in fishing, but the fishing along the east coast is most important (Fig. 183). Herring caught in nets set by drifters are shipped in large quantities from *Aberdeen* and other coast cities to London and the continent. *Dundee* formerly had its fleet of ships which sailed to the Arctic Ocean to capture whales and seals, but on account of the scarcity of these animals the industry has greatly diminished in importance.

Sec. 429. Mining and manufacturing.—The coal mines of the Lowlands are the centres of the manufacturing industry. One important coal field is found in the west near the Clyde River and another in the east on both sides of the Firth of Forth (Map 41 in Atlas). Indeed, it is believed that the coal seam passes right under the Firth from the coal field on the north side to the coal field on the south side. Although the iron mines supply a part of the ore for making iron goods, yet it is necessary to import much ore to meet the full requirements of the iron workers. *Glasgow*, together with the region on both sides of the River Clyde, is the centre of the iron industry and is the greatest ship-building district in the world. Glasgow, the second city in the United Kingdom, with a population of over one million, is also engaged in the manufacture of chemicals, cotton goods, and carpets, and on account of its supplies of pure water does much bleaching and printing of goods woven in other cities. *Paisley*, not far from Glasgow, manufactures more spools of thread than any other city in the world.

While the coal fields in the Glasgow region are already well developed, the newer ones on both sides of the Firth of Forth are gaining rapidly on the former, and manufacturing in the east is growing by leaps and bounds. *Edinburgh*, the capital, is a beautiful city near the Firth of Forth. Although it is pre-eminently a residential city, the manufactures are important and increasing in numbers. The printing of books, map-making, and the brewing of liquors are some of its oldest and most important industries. *Dundee* is noted for its manufacture of cloth from jute, hemp, and flax. *Kirkcaldy* on the Firth of Forth is a rapidly growing port and manufacturing town. It is engaged largely in manu-

facturing textiles and was the originator and is still the chief producer of oil-cloth and linoleum.

The Southern Uplands

Sec. 430.—The Southern Uplands of Scotland, though not so high or rough as the Highlands, are largely composed of a low plateau cut deeply by the many rivers. The elevated parts, which are somewhat flat-topped and clothed with grass, supply pasturage for the largest flocks of sheep found anywhere in Scotland, and in the valleys are raised the chief crops of the region. Although not nearly so densely populated as the Lowlands to the north, it is much more developed than the more barren and austere Highlands and has a denser population. Apart from agriculture the chief industry is the manufacturing of woollen goods, which is concentrated along the *Tweed River*. The local supply of wool, the abundance of suitable water for washing the wool and for power, together with the close proximity to the coal fields of Newcastle in England have all contributed to make this a centre of woollen manufacture. The most important kind of cloth woven is tweed, named after the river along which the manufacturing is done, and Scotch tweed is notable for its good quality.

Ireland

Sec. 431.—Ireland is divided into two countries, North-east Ulster and the Irish Free State. North-east Ulster, whose capital is Belfast, besides having its own parliament, sends members to the British House of Commons. The Irish Free State, on the other hand, has much the same status in the British Empire as Canada and sends no members to the Imperial Parliament. Its capital is Dublin. The northern state is largely Protestant while the southern state is largely Catholic.

Sec. 432. Surface.—The more mountainous parts are in the west, north, and south (Map 33 in Atlas), while the central plain occupies the greater part of the interior and extends to the coast on both the east and west sides. The mountainous parts do not possess the continuity to be found in the Highlands of Scotland but are separated into a number of masses by intervening lowlands. The drainage of a large portion of Ireland is so poor that much of it is covered with bogs, which are often filled with peat. Frequently the water of the rivers is stained quite dark when it comes from the peat bogs, and this is the reason that the name Blackwater is given to several rivers. The bogs are unsuitable for cultivation,

but often strips of firmer, drier land, which run between bogs, make excellent farms.

Sec. 433. Drainage.—Ireland has only one large river, the *Shannon*, which has several lake expansions and by the aid of canals is navigable for the greater part of its length. Ireland is dotted with many lakes. *Lough Neagh* in the north-east is the largest lake in the British Isles, and the *Killarney Lakes* in the south-west are famous for their beautiful surroundings.

Sec. 434. Agriculture.—The warm, moist, westerly winds from the Atlantic Ocean produce such a mild climate and abundant rainfall (Map 37 in Atlas) that vegetation is of so luxuriant greenness that Ireland is called the Emerald Isle. Indeed, moisture is so abundant that many parts are more suitable for pasturage than for the cultivation of grains (Map 40 in Atlas). Consequently cattle-raising and dairying are the great industries of rural Ireland. Fat cattle, milk, and butter are shipped in great quantities across the Irish Sea to England. The chief crops are oats, potatoes, and flax, the latter being chiefly cultivated in the Province of Ulster (Fig. 73). During the last fifty years the amount of land under crops has been steadily decreasing and the amount in pasturage increasing.

Sec. 435. Manufacturing.—Ireland has little mineral wealth of any kind. The coal which is found is small in quantity and poor in quality. As the surface is not mountainous there is little water-power. Consequently one of the chief requirements for successful manufacturing is absent. The eastern side of Ireland, however, is close to the iron and coal fields of England, Wales, and Scotland, and it is in this part and especially in the north-east that manufacturing is carried on. In *Belfast*, the most populous city, are the largest linen manufactures in the world, and the product is unsurpassed in quality. Some of the largest shipyards in the United Kingdom are in the same city, which is both the commercial and manufacturing centre of the country. In *Dublin*, which is the chief industrial city of the East, brewing, distilling, the weaving of poplin (a fine fabric made of a mixture of wool and silk) and biscuit making are the outstanding manufactures. Dublin, however, owes a good deal of its importance to the fact that it is the political and social centre of the country. There are few industries in the south. *Cork*, which is the centre of a region in which dairying and the rasing of hogs are important, has a large branch of the Ford works for the manufacture of tractors. *Queenstown* in the south is the first calling place of ships from America.

CHAPTER XXIX

FRANCE

Sec. 436. Situation. -France has the finest situation of any country in Europe. The north is separated from Britain only by the English Channel; the south, washed by the Mediterranean Sea, is most conveniently situated for commerce with the East; the east is now in contact with the Rhine River, on whose waters thousands of ships ply; and the west on the Bay of Biscay faces the rich populations of America. Though the Alps and Jura Mountains seem to form a barrier between France on the one side and Switzerland and Italy on the other, the Mt. Cenis tunnel gives it fair communication with the fruitful plain of Northern Italy, and the valley of the Rhone River gives admittance into the industrial parts of Switzerland. The snow-capped Pyrenees with no low passes, however, form a formidable barrier to communication by land with the Iberian Peninsula.

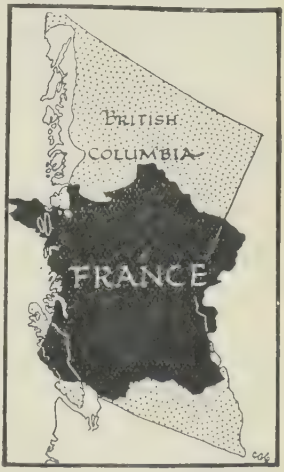


FIG. 184. RELATIVE SIZES OF FRANCE AND BRITISH COLUMBIA

The coast is fairly regular. Along the Bay of Biscay and the English Channel the mouths of the rivers are tidal estuaries, as in Britain, and form excellent harbours. On the Mediterranean, where there are no tides, good harbours are few, though *Marseilles* is the greatest seaport in the country (Fig. 184).

Sec. 437. Climate.—As the surface gradually rises from west to east, the moist, westerly winds penetrate almost to the east of the country. Consequently the temperatures in most parts of the country are delightful, neither warm in summer nor cold in winter, and the rainfall is sufficient in almost all parts (Maps 35, 36, and 37 in Atlas). In the narrow valley of the Rhone, however, the climate is more like that of the other Mediterranean

countries, hot and dry during the summer and rainy during the winter.

Sec. 438. Surface and drainage.—The western half of France is a plain, which is low and sandy in the south, alluvial in the centre, and very flat in the north (Map 33 in Atlas). The eastern half is high. The southern part of the eastern plateau is separated into an eastern and a western section by the valley of the Rhone River, which has formed for many centuries one of the chief highways of commerce between the Mediterranean Sea and Northwest Europe. The eastern plateau diminishes in height toward the north and breaks up into the rough country called the *Ardennes*.

With the exception of the Rhone all the large rivers run for the greater part of their courses through the lowlands and empty into the English Channel or the Bay of Biscay. Moreover, these westerly flowing rivers all have estuaries at their mouths. Consequently, they are navigable for the greater part of their courses. The chief of these are the *Seine*, which flows into the English Channel, and the *Loire* and the *Garonne* into the Bay of Biscay. The Rhone, which rises in the Alps, and after expanding into the Lake of Geneva, enters France and flows south, has many rapids and waterfalls. But all of these have been more or less successfully overcome so that it is now navigable up as far as Geneva. The value of these rivers for transportation has been greatly increased by a remarkable system of connecting canals, by which it is possible to pass from any one of the large rivers to the adjoining ones. On account of the level character of the western part of the country and the many low gaps cut by the rivers through the eastern highlands, railway building has been comparatively easy, and as a result the whole country is well supplied with railways. These ramify in every direction from Paris much as the spokes of a wheel from the hub.

Sec. 439. Agriculture.—France is one of the finest agricultural countries in Europe. The most fertile soil is in the north, and as there is abundant moisture and the temperature is moderate at all seasons, the wheat crops of this region have put France next to Russia in the production of wheat among the countries of Europe (Fig. 185).

As the greater part of the surface of France is arable, the rainfall adequate and well distributed, the temperatures high, and above all the peasants skilful, hardworking, and thrifty, agriculture is the chief industry of the country. Indeed, over one-half of the whole population is engaged in farming. Rye is grown in the highlands in the south-east and oats in the same region as wheat (Figs. 185 and 197). Cattle are numerous in the north and sheep in the less fertile lands to the south (Figs. 175 and 176).

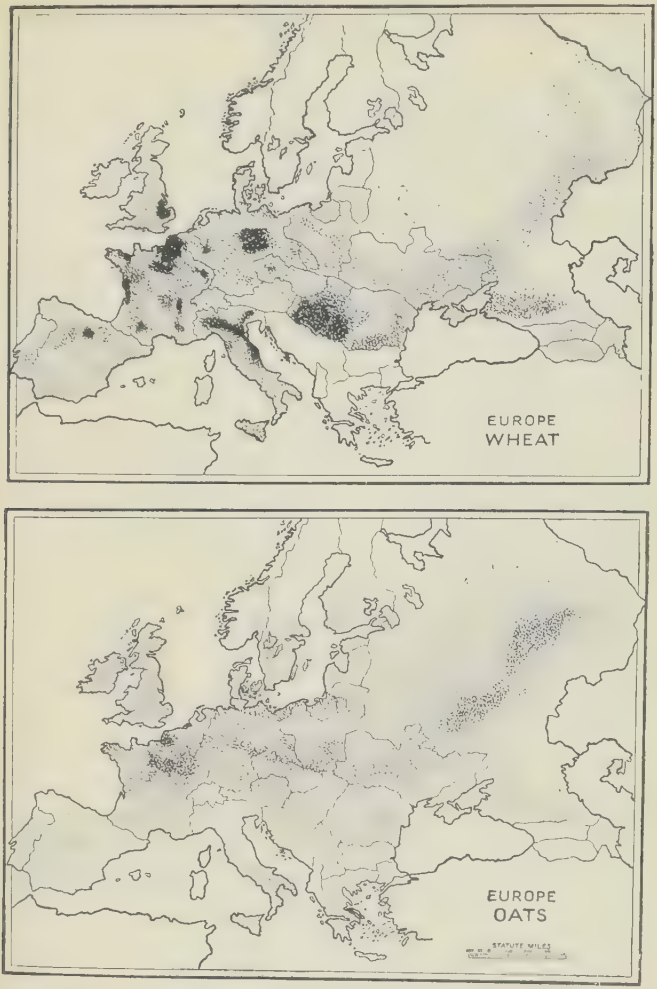


FIG. 185. DISTRIBUTION OF WHEAT AND OATS IN EUROPE

Name the great wheat-growing countries of Europe. Name the chief oat-growing countries.

In the valley of the Rhone and along the Mediterranean coast, olives and the vine are very important (Fig. 200). The vine is also grown along the Garonne River and in the north, especially in the province of Champagne. Wherever the vine flourishes wine is an important product. In the valley of the Rhone is also grown the mulberry, whose leaves are fed to the silkworm.

Sec. 440. Mining and manufacturing.—Formerly France was not well supplied with minerals. But after the Great War her position in this respect was greatly improved, since she received back Lorraine, which contains valuable iron mines, and the Saar Valley which contains important coal mines. She has also coal mines in the north. But both coal and iron have to be imported for her manufacturing. The iron manufactures centre around *Nancy* in the east. The manufacture of textiles, especially of cotton and linen, is very important in the north in the great city of *Lille* and vicinity. Next to the United States France leads the world in the manufacture of silk. This industry is concentrated in the valley of the Rhone, especially at *Lyons*. The artistic taste of the French people has led to their leadership in the manufacture of gloves, fine slippers, jewellery and other ornaments and articles.

Sec. 441. Seaports.—France, with its excellent harbours, its large, industrious population, its great agricultural wealth, and its numerous manufactures, has several great seaports through which pass its exports and imports. *Havre*, near the mouth of the Seine, is the seaport of Paris and the thriving Seine basin. *Bordeaux*, near the mouth of the Garonne River, is the centre of the wine trade of the Garonne Valley. *Marseilles*, on the Mediterranean Sea and near the mouth of the Rhone River, is the most important seaport in France.

Paris is the largest, gayest, and in many respects the most beautiful city on the mainland of the continent of Europe. Only London and New York surpass it in size. As the capital of the French Republic, the most centralised government of Europe, it contains almost all the important government offices. The valley of the Seine is one of the most fertile spots in Europe, and all the branches of the Seine meet near Paris. Though not a great manufacturing city it is the centre of production of those artistic articles for which France is so noted. Its buildings, parks, boulevards, and monuments are unsurpassed in beauty and magnificence on the continent.

CHAPTER XXX

BELGIUM

Sec. 442.—Belgium and Holland together are often called the Low Countries, on account of the greater part of the surface of both being very little above the level of the sea. Indeed, a considerable part of Holland and a small part of Belgium are actually lower than the sea, and the water is kept out by means of great banks of earth called dikes. Belgium, in its surface, language, religion, and industry resembles France, while Holland in these respects is more akin to the adjoining parts of Germany (Fig. 186.)

In the half of Belgium adjoining France the people are of a different race and language from those living in the northern half. The southerners are called *Walloons* and speak the French language, the northerners are called *Flemings* and speak a language resembling Dutch. Many places in Belgium have both a French and a Flemish name. For example, the chief river, which is called the *Meuse* in French, is called the *Maas* in Flemish.

FIG. 186. RELATIVE SIZES OF HOLLAND AND BELGIUM AND NEW BRUNSWICK

The Belgians are an alert, industrious, intelligent people. They are well educated, and almost all are devout adherents of the Roman Catholic religion. It is the most densely populated country in Europe.

Sec. 443. Agriculture.—Although Belgium is pre-eminently a manufacturing country, agriculture is nevertheless of great importance. The westerlies blowing in from the Atlantic Ocean bring mild weather at all seasons and sufficient rainfall (Maps 35, 36, and 37 in Atlas). In the west, where the land is low and fertile, the cereals, wheat, oats, and barley, as well as flax and sugar-beets, are intensively cultivated on small farms generally owned by the peasant proprietor (Figs. 185, 197, and 208). In the east where the land is higher, rougher, and more barren the grazing of sheep and cattle becomes more important (Figs. 175

and 176), and rye and oats replace wheat as the chief cereals. In the land reclaimed from the sea and shut in behind the dikes, where there is a luxuriant growth of grass, dairying is most marked, and butter and cheese are the chief exports.

Sec. 444. Manufacturing.—As might be expected from its dense population Belgium is a very important manufacturing country. The many canals and rivers form a network of inland navigation, and the level character of the country makes railway building inexpensive. Belgium has a greater mileage of railways according to its area than any other country in the world. The large coal mines in the east with the adjacent iron mines in Luxemburg and Lorraine give the two minerals so important for industry. Most important of all is the abundance of skilful, intelligent labourers. Iron and steel goods are manufactured in the east; cotton, linen, and woollen goods in the west.

Sec. 445. Cities.—The two great cities are *Brussels* and *Antwerp*. Brussels, the capital, is centrally located and from it ramify many railways. Antwerp was at one time the greatest seaport in the world. After a period of decline, it has during the last fifty years gained back much of its importance and is now one of the most important commercial cities in Europe. It is situated on the *Scheldt* River, whose channel has been so deepened that the largest ocean liners can now reach its docks.

Sec. 446. Colonies.—The Belgian Congo in Africa, formerly the Belgian Free State, is the only colony.

CHAPTER XXXI

HOLLAND OR THE NETHERLANDS

Sec. 447.—The Frisian Islands stretching along the North Sea coast mark the former boundary of Holland. But severe storms broke through the sand dunes and flooded much of the country, including the region now covered by the Zuider Zee, a shallow body of water, which is likely to be pumped out and brought under

FIG. 187. A VIEW OF DORDRECHT, HOLLAND

cultivation. As has been already stated, a good deal of the land adjacent to the North Sea is at a lower level than the water in the sea and is kept from being flooded by dikes built up between it and the water. The rain that falls is pumped out often by great windmills, which are seen all over the flat country, giving a pleasant relief to the landscape.

Sec. 448. Agriculture.—In the diked region the warm winds and the moist, alluvial soil produce the most luxuriant grass, which forms excellent pasturage for the dairy herds. Dutch butter and cheese are notable for their excellent quality and form two of

the chief exports. The eastern part of the country is composed of barren, glacial deposits, containing many stones, and is suitable for the growth of rye and the grazing of sheep. Sugar-beets are extensively grown in the south.

Sec. 449. Other industries.—Although Holland has excellent means of communication, and raw products are readily accessible, she has never developed manufacturing as her neighbour, Belgium, has. One serious difficulty is the lack of coal, as only a small quantity is mined. The making of cotton and woollen goods, the cutting of diamonds, and the refining of raw sugar, much of which comes from her important colonies in the East Indies, are the chief manufacturing operations.

Sec. 450.—*The Hague* is the capital of Holland. *Amsterdam* and *Rotterdam* are important ports as well as great commercial cities.

CHAPTER XXXII

GERMANY

Sec. 451.—After the Great War Germany lost about thirty thousand square miles of territory and a population of over eight millions, so that it dropped from second to fourth place in size among the countries of Europe (Fig. 188). On the west it lost Alsace-

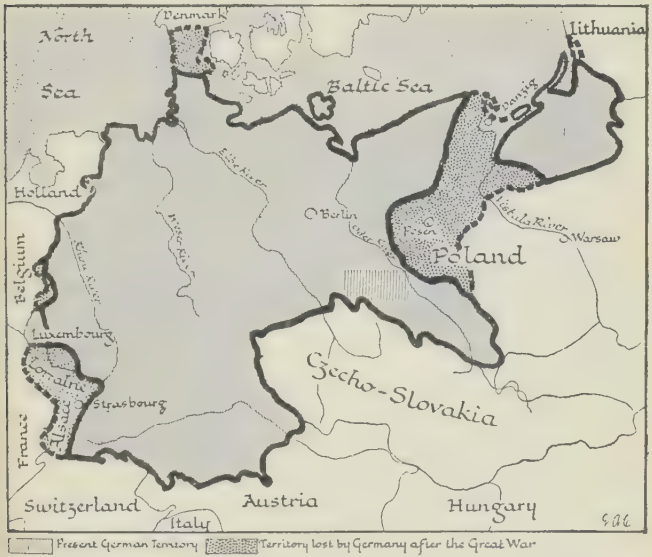


FIG. 188. GERMANY, BEFORE AND AFTER THE GREAT WAR

The heavy line marks the present boundaries of Germany. The heavy dotted line marks the boundary before the Great War. Estimate what part of her territory Germany has lost.

Lorraine to France, on the north a small amount of territory to Denmark, and on the east a large district to the newly constituted country of Poland. Indeed, a long narrow strip of Poland, which extends to the Baltic Sea, cuts Germany into two parts entirely separated from each other (Fig. 189).

In the wealthy industrial province of Silesia a vote of the people was taken to decide which parts of it preferred to be joined to Germany and which to Poland. The total vote was very greatly in favour of union with Germany. It was finally divided between the two countries.

Sec. 452. Surface.—The northern half of Germany is a plain, the southern part a plateau (Map 33 in Atlas). The southern part of the plateau is the highest, and part of it, which is composed of the northern extension of the Alps Mountains, contains many lakes and much glacial deposit. The northern part of the plateau is lower and more broken than the southern part. In fact it is the remnant of a very ancient highland, which has been deeply eroded (Sec. 409). In these ancient highlands is found the chief mineral wealth of the country.

FIG. 180. RELATIVE SIZES OF GERMANY AND QUEBEC

Sec. 453. Rivers. — With the exception of the Danube all the important rivers of Germany rise in the highlands of the south, cut their way through the ancient highlands in deep gorges, and flow across the plain to either the Baltic or the North Sea. All are navigable throughout the greater part of their courses and are connected with one another by a network of canals, which rival those of France. The most important are the *Rhine*, *Elbe*, and *Oder*. The Rhine, which is one of the most important rivers in the world, rises in the Alps, expands into *Lake Constance*, then turns north, flows through one of the most densely populated parts of Central Europe, and turns west through Holland to empty into the North Sea. The traffic that passes up and down in the nine thousand ships which ply its waters is very great.

Sec. 454. Climate.—On account of the prevalence of the westerlies blowing in from the North Sea the climate of the west is very moderate, but becomes more extreme toward the east, where the winters are not unlike those of Eastern Canada (Maps 35 and

30 in Atlas). In the eastern part of the country the rivers freeze up for several months during the winter, the harbours are blocked with ice, and the ground is covered with snow. There is not much change in temperature between the north and the south, as the greater altitude of the south compensates for its nearer proximity to the Equator.

The westerlies bring adequate rainfall to the western side of Germany, but the precipitation decreases toward the east; yet even in this part the rainfall is quite sufficient to enable the people to grow the common cereals (Map 37 in Atlas).

Sec. 455. Agriculture.—Much of the land of Germany is rather barren, but intelligence, industry, and scientific agriculture have conquered the barrenness of the soil, and there is a smaller ratio of waste land than in any other of the great countries of Europe. Nowhere has the use of fertilizers and intensive cultivation achieved greater results. Germany's agricultural productions are probably greater than those of any other country in Europe except Russia. Wheat is grown in the central parts (Fig. 185), rye in the more sandy plains along the Baltic (Fig. 197), barley in the south-western states, and oats in most parts of the country. Potatoes are grown more extensively than in any other country in the world (Fig. 208). The sugar-beet is produced in such large quantities that before the war Germany manufactured more sugar than any other country in the world except Cuba. She leads Europe in the production of pigs, which thrive on the beet refuse from the sugar factory. Cattle, horses, and sheep are also raised in great numbers (Figs. 175 and 176).

Sec. 456. Lumbering.—Germany has been very careful to conserve her forest wealth, and all the mountains are clothed with forests of hardwood and pines. Further, much waste land has been planted with trees, so that the raising of trees for their timber has become a branch of agriculture.

Sec. 457. Fishing.—In the years before the war Germany was busy preparing a great navy and was very anxious to train many of her people to a seafaring life. As the most effective means of accomplishing this, she endeavoured to develop the fishing industry. With the North and Baltic Seas along her northern border this was easy. As a result the fisheries have rapidly developed. Cod, haddock, and herring are the chief fish caught off her coasts.

Sec. 458. Mining. Among the countries of Europe Germany's mineral wealth is only surpassed by that of Britain. In the worn down mountains of the central highlands are found the chief mines. The most valuable lead and zinc mines of Europe are found in *Silesia* on the east, and in the same region are found coal, nickel and iron. Along the lower Rhine in the province of

Westphalia and in the vicinity of *Essen* are situated very valuable coal mines. Mineral salts of the greatest importance to commerce and agriculture are also found in large quantities. Some of her finest coal and iron mines were in the territory that was handed back to France after the Great War.

Sec. 459. Manufacturing. -Only within the last forty years has Germany developed into a great manufacturing country. Her rapid growth in industry is chiefly due to the opening of her coal and iron mines, the great attention paid to scientific and technical education, the industry and skill of the German people, and the rapid increase in her population, which gave her an abundance of skilled labour. The manufacturing establishments, as is usual, gather around the coal fields. Iron goods, cotton, woollen, and linen fabrics are manufactured on the lower Rhine, in Silesia, and in Saxony. Chemicals, dyes, scientific apparatus, furniture, leather and paper goods are manufactured in the cities of Western and Southern Germany.

Sec. 460. Cities.—Since Germany is the greatest manufacturing country on the mainland of Europe, she is sure to have many great cities. *Berlin* is the greatest of these and the third largest in Europe. Besides being both the capital of the German Republic and of Prussia, the dominant state in the Republic, it is the main railway centre of the country. Moreover, it is the cultural and intellectual centre of the German people. In the manufacturing region along the Rhine River there are many important cities such as *Cologne*, with its magnificent cathedral, *Frankfort*, a great social and banking centre, and *Essen*, notable for the great iron works of Krupp's, which furnished the Germans with so many of their guns during the Great War. *Munich*, the capital of the Catholic state of Bavaria, has great and varied manufactures. Saxony, the most densely populated state in Germany, has great cities, the chief of which are *Dresden* and *Leipzig*. Dresden, the capital of Saxony, is often called the Florence of Germany on account of its fine art collections. Leipzig is both a commercial and manufacturing city; it manufactures more books than any other city in Europe.

Germany with its large imports of foods and raw materials and its large exports of manufactures has great seaports, the chief of which are *Hamburg* and *Bremen*. Hamburg is the most important seaport on the continent.

Sec. 461. People.—The German people are industrious, skilful, and highly intelligent. They are fond of music, excel in the application of science to industry, and are very much attached to their country. They are less vivacious than the people of Southern Europe.

CHAPTER XXXIII

SCANDINAVIA

Sec. 462.—The name *Scandinavia* is applied to the four countries, Norway, Sweden, Denmark, and Iceland, because the inhabitants all belong to the same race, speak very similar languages, and resemble one another in their appearance and customs. They are akin to the English and Germans.

Norway and Sweden

Sec. 463. Surface.—The Scandinavian Peninsula includes Norway and Sweden. In structure and climate it greatly resembles British Columbia. A plateau, which extends from one end of the peninsula to the other, runs so close to the Norway coast that there is scarcely any coastal plain (Map 33 in Atlas). The land slopes off much more gradually toward the Baltic Sea and Gulf of Bothnia. Consequently, Sweden has much more land fit for cultivation than has Norway. The whole western coast is indented with long, narrow fiords (Sec. 320) and so fringed with islands that a ship can cruise along the whole coast without feeling the full force of the Atlantic Ocean. These differences in physical features have much to do in determining the character and occupations of the peoples. The Norwegians, hemmed in between the mountains and the ocean, compelled to look to the sea for an existence, and enticed to sail on its waters by the excellent harbours and numerous islands, have become great sailors and fishermen. The Swedes, on the other hand, are engaged chiefly in farming and lumbering.

Sec. 464. Climate.—The plateau, running north and south, cuts off the moist westerlies from Sweden and produces markedly different climates in the two countries (Maps 35, 36, and 37 in Atlas). In Norway the summers are cool and the winters so mild that none of the harbours even in the extreme north are icebound. This country also has an abundant rainfall. Sweden on the other hand has hotter summers, and winters so cold that all the harbours on the Baltic and its prolongation the Gulf of Bothnia are stopped with ice during the winter. Indeed, in the northern part the ice remains for as long as six months. As the plateau robs the

westerlies of much of their moisture, the precipitation in Sweden is much less than in Norway.

Sec. 465. Agriculture.—More than half of the people of both countries are engaged in growing cereals or raising cattle and sheep (Figs. 175, 176, 185, and 197). As the people are very intelligent and skilful, they cultivate the land with great success, and every valley and raised beach in Norway is made to yield its share of food. In Sweden of course there is much more arable land.

Sec. 466. Lumbering.—As a great part of both countries is covered with forests of pine and fir, very large quantities of timber are cut, floated down the rivers, and made into lumber to be shipped to the countries of Europe whose forests have been destroyed. Much of the smaller timber is made into pulp. Products of wood are by far the most important exports.

FIG. [illegible] RELATIVE SIZES OF QUEBEC AND [illegible] SCANDINAVIAN PENINSULA

The area of Quebec is 700,000 square miles. Estimate the area of Norway and Sweden.

Sec. 467. Fishing.—In all the villages nestling along the numerous fiords of Norway fishing is the chief industry. Herring are caught all along the coast, and cod is especially abundant toward the north. Whaling retains only a part of its former importance. The oil of the whale is still used by many of the villages instead of kerosene as a luminant during the long winter darkness.

Sec. 468. Manufactures. Scandinavia has the most abundant water power of any region in Europe, and this is just beginning to be used for manufacturing. Lumber, paper, matches, and other wooden goods are the leading products of the factory. But as Sweden has some of the finest iron mines in Europe, the production of iron and especially steel is important. Indeed, Swedish steel is the best in Europe.

Norway, with her seafaring people, has many ships and carries goods to all parts of the world. *Bergen* on the Atlantic coast is the great seaport of Norway. In Sweden an inland waterway from *Gothenburg* to the Baltic Sea has been made by utilizing the large

(*Courtesy of Royal Swedish Consul General*)

FIG. 191. THE NORTH STREAM WITH THE FERRIES, STOCKHOLM

lakes, *Wener* and *Wetter*, by deepening the rivers, and by cutting a considerable length of canal.

Christiania, the capital of Norway, and *Stockholm*, the capital of Sweden, are the two most important cities (Fig. 191).

Sec. 469.—Sweden has no colonies, but the island of *Spitzbergen* in the Arctic Ocean has recently been ceded to Norway.

Denmark

Sec. 470.—Denmark is composed of the low, sandy peninsula of *Jutland* and the fertile islands, *Funen*, *Laaland*, and *Zealand* (Fig. 192). As it guards the entrance to the Baltic Sea it has great strategic importance, and the leading nations of Europe have always jealously preserved its independence.

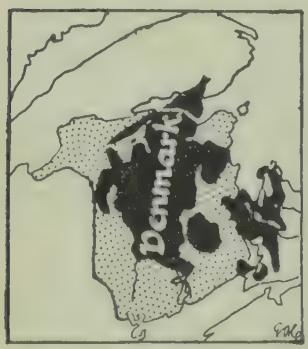


FIG. 192. RELATIVE SIZES OF DENMARK AND NEW BRUNSWICK

The area of New Brunswick is about 28,000 square miles. What is the area of Denmark?

Sec. 471. Industries.—The Danes have specialised on one small branch of industry, namely, the making of butter, and this product forms their chief export. While they raise some of the cereals, their main energies are directed to producing dairy cattle (Figs. 175 and 176). Over ninety per cent. of the milk is used for butter making. The skim-milk and buttermilk are used for feeding pigs. After butter, eggs and bacon are the next most important exports.

There is considerable fishing but little manufacturing. *Copenhagen*, the capital, is the only large city.

Greenland and the *Faroe Islands* belong to Denmark.

Sec. 472. Iceland.—Formerly Iceland was a colony of Denmark, but recently it has gained its independence, and its chief tie with Denmark is that both have the same king. Iceland is largely a volcanic highland, a considerable portion of which is covered with snow. The lowlands, where all the population is found, have a moderate climate. Indeed, there are harbours in the west that are never icebound. Though cereals do not ripen well, luxuriant grass is grown in the meadows, and the rearing of cattle and sheep is the chief industry. There are also important fisheries.

CHAPTER XXXIV

POLAND

Sec. 473.—Poland at one time in its history extended from the Baltic to the Black Sea. Later the whole country was divided among Prussia, Austria, and Russia. After the Great War it came into existence again. The parts of these three countries whose inhabitants were chiefly Poles were combined to form the new country. In area it is now one of the large countries and has a population three times as great as that of Canada.

The northern section is low and parts of it are very fertile. It rises gradually toward the south. The summers are hot and the winters are cold enough to close up all the rivers with ice for from four to five months.

Sec. 474. Industries.—The industries of Poland are varied. Agriculture is the most important. Crops of all the common cereals are very generally raised (Figs. 185, 197). The land is largely owned by the wealthy nobility, and they are severe task-masters to the peasants, who are always in debt. In the south there are important mines of coal, iron, lead, and zinc. As much of the country, especially in the south, is covered with timber, lumbering is very important, and the *Vistula River* and its branches are of great importance in bringing the lumber to the Baltic Sea to be shipped to Britain and other European countries. With its dense population, and its iron and coal mines, Poland is bound to become an important manufacturing country. This industry has been greatly stimulated by Germany and is largely in the hands of Germans. The most important manufacturing city is *Lodz*, which is as large as Toronto and is particularly noted for its cotton mills.

Sec. 475.—*Warsaw*, the capital, is one of the great cities of the world. It is pre-eminently a commercial city. It stands on the main route between western and eastern Europe and has no less than six great railways passing through it. It is also at the centre of the traffic along the Vistula River.

Danzig was formerly the great seaport of Poland. On the restoration of that country, Danzig, on account of its predominant German population, was not restored to Poland but made an independent state, whose port was free to the commerce of both Poland and Germany.

Sec. 476.—Poland is the original home of the Slavs. From this centre they spread eastward and southward over a large part of Europe and have in a few hundred years so multiplied that to-day they are the most numerous people in Europe. The Poles are proud, intensely patriotic, fiery in disposition, and defend their country with the most desperate courage.

CHAPTER XXXV

AUSTRIA

Sec. 477.—No country in Europe suffered such a serious loss of territory after the Great War as Austria (Fig. 193). In the north and east she was shorn of her most fertile and populous provinces, Bohemia, Moravia, and Galicia; in the south the

FIG. 193. AUSTRIA, BEFORE AND AFTER THE GREAT WAR

The heavy line marks the present boundary of Austria, the heavy dotted line marks the boundary of Austria before the Great War. What part of its area has been lost?

Trentino and Istria were lost to Italy; and her Slav provinces in the south became parts of Jugo-Slavia. As a result Austria has dropped both in size and importance from a first to a third class power (Fig. 194).

Sec. 478. Surface.—The country is largely occupied by the mass of the Eastern Alps, which are more extensive than and almost as massive as the Alps of Switzerland (Map 33 in Atlas). The ranges

run from east to west. The western part is the most mountainous. The Brenner, in many respects the most notable pass across the Alps, cuts across the western part of Austria by way of the valley of the *Adige River*. Through many centuries this pass was the chief route by which goods were transported from the Mediterranean region to Germany.

Only in the north-east along the valley of the Danube are there fertile lowlands.

Sec. 479. Industries.—A large part of the country is unsuitable for cultivation, but along the valley of the Danube in the province of Lower Austria, and even in some of the valleys of the Alps, agriculture is extensively carried on. Wheat, rye, oats, sugar-beets, grapes, and potatoes are the chief crops, and in the rougher parts the grazing of cattle and sheep is an important industry (Figs. 175, 176, 185, 197, and 208).

FIG. 194. RELATIVE SIZES OF AUSTRIA AND SOUTHERN ONTARIO

The area of Southern Ontario is about 80,000 square miles. What is the area of Austria?

The mineral wealth of the more mountainous parts is very considerable. Iron is widely distributed, and lead and salt are mined.

The manufactures of the west are dependent on the minerals. Much iron is smelted and made into cutlery and tools. The extensive water-power from the Alps is used for the weaving of cotton and silk goods. In the industrial region along the Danube River brewing, milling of flour, spinning, weaving, and the making of iron goods are of great importance. *Vienna* is the centre of the industrial life of this region.

Sec. 480. People.—Austria is a country without a language. Its people are for the most part German and speak the German language. The chief religion is Roman Catholicism. The homogeneity of the people has been greatly improved by the loss of territory during the Great War. Before that the number of Slavs was much greater than the number of Germans. But the loss of the Czechs, Moravians, and Ruthenians on the north and of Italians, Slovenes, and Croats on the south has made the Germans predominant in numbers as well as in political influence.

Sec. 481. Vienna, the fourth city in population in Europe, is

the capital and chief city. Its situation is excellent. It is on the Danube at the point where that river leaves the highlands for the Hungarian Plain. The *March River*, after flowing through a plain, empties into the Danube just below Vienna and brings the city into communication with one of the most densely populated industrial districts of Europe. Besides its pivotal position on the Danube, the longest navigable stretch of inland waters in Europe outside of Russia, it is along the line of the most important railways in Europe; one comes from Paris, one from Berlin, and one terminates in Trieste, the most important seaport on the Adriatic Sea.

The people of Vienna are gay, fond of dress, music, and dancing. Their fine artistic taste shows itself in their manufactures, which consist of beautiful silk and leather goods, jewellery and other luxury articles. It also has extensive manufactures of metal goods and textiles.

With Austria shrunken in size and importance the agricultural and industrial regions served by Vienna have greatly diminished in size and wealth, and the future of this great city looks none too bright.

CHAPTER XXXVI

CZECHO-SLOVAKIA

Sec. 482.—This country, which sprang into existence at the close of the Great War, is composed of what were formerly the best parts of Austria, namely Bohemia, Moravia, Silesia, and the western part of Galicia. It thus has Austria and Hungary to the south of it and Germany and Poland to the north. In size it surpasses Austria and is about as large as Hungary (Fig. 195).

Sec. 483. Surface.—It is largely occupied by highlands, which

FIG. 105. RELATIVE SIZES OF NOVA SCOTIA AND CZECHO-SLOVAKIA

The area of Nova Scotia is 21,500 square miles. What is the area of Czecho-Slovakia?

in the east form a plateau with the Carpathian Mountains along the centre forming a backbone. The lowest parts are in the valleys of the Danube and the Elbe. Bohemia is bounded on three sides by mountains, which, except in the north-east, are not high.

Although Czecho-Slovakia has no direct contact with the sea, it is particularly fortunate in having excellent river navigation. The Elbe is navigable as far as *Prague* and much of the imports and exports pass along this river, so that Hamburg is the chief seaport for this country. The Danube, which forms its southern boundary, is navigable right to the Black Sea.

Sec. 484. Agriculture.—Though parts of the country are mountainous and parts are comparatively barren, a very large section is suitable for cultivation and is very intensively tilled by the dense

population. Oats, rye, sugar-beets, potatoes, and hops are important crops, and in the higher and more barren lands sheep and cattle are pastured (Figs. 175, 176, 185, 197, and 208).

Many of the higher parts in the Carpathian Mountains are wooded with both coniferous and broad-leaved deciduous trees, and lumbering is important.

Sec. 485. Mining and Manufacturing.—On account of the iron and coal mines of Bohemia, Silesia, and the state of Saxony in Germany just to the north of Bohemia, Czecho-Slovakia is one of the most intensively industrialized regions in continental Europe. The textile manufacturing is of the greatest importance. The spinning and weaving of cotton and woollen goods, which was formerly and is even yet to a great extent an important domestic occupation in the higher lands surrounding Bohemia, is now carried on in factory towns of the same region, for which purpose the water powers from the mountains are extensively used. Foundries and engineering works are important, and large breweries and distilleries are very widespread. Bohemia produces large quantities of sugar from sugar-beets. The manufacture of glassware and porcelain is also centred in Bohemia, where the necessary raw materials, pure sand, pure clay, and coal, are found.

Although Czecho-Slovakia is hemmed in by mountains throughout a great part of its border, there are low gaps made by the rivers through which the railways readily pass.

Sec. 486. People.—The people of Czecho-Slovakia are predominantly Slavs, though there are many Germans in the higher lands surrounding Bohemia on three sides and in many of the industrial towns. The Slavs of Bohemia are called *Czechs*, those of the eastern part of the country *Slovaks* and *Ruthenians*.

Sec. 487. Prague, on a branch of the Elbe River, is the capital and largest city. Situated near the centre of Bohemia, the most densely populated part of the country, it is both the industrial and commercial centre. Being a very ancient town, with a rich and varied history, it has many buildings and museums of great interest.

CHAPTER XXXVII

ESTHONIA, LATVIA, AND LITHUANIA

Sec. 488.—The three new countries that, as a result of the revolution in Russia, have arisen on the Baltic Sea are inhabited by three of the most remarkable races in Europe. In the north are the *Esthonians* or Esths, a race closely related to the Finns; farther south are the *Letts* along the Baltic coast and the *Lithuanians* farther inland. The two latter races are closely related to the Prussians and to each other. We are entirely in the dark as to their origin, but the Lithuanian language is more nearly related to the Latin and Sanskrit than to the surrounding languages.

These three border states are comparatively low and are covered with glacial deposits, including many granite boulders from Finland.

The climate is severe in the winter but warm in the summer (Maps 35, 36, and 37 in Atlas). The moist, westerly winds, however, diminish the cold of the winter and the warmth of the summer.

The soil is stony and not very fertile, and the chief crops are rye, oats, barley, and potatoes, with flax in the east (Figs. 73, 185, 197, 208). Besides, large numbers of cattle are reared and dairy farming is carried on extensively (Fig. 175). Nowhere in what was formerly Russia is so little of the land owned by the peasants. Almost all of it is in the hands of German landlords in the north and of German and Polish landlords in the south, who form the nobility in these states. The peasants, who work as tenants, are in a condition of great wretchedness and poverty, being little better than serfs to the landowners. Since the educated nobility direct the farm operations, nowhere in the former Russian Empire is agriculture conducted with greater efficiency. Since these provinces gained their independence, there has been an effort to take the land from the owners and hand it over to the peasants.

Along the coast great numbers are engaged in fishing, especially for *anchovies*.

As these three states lie in the forest belt, the manufacture of paper and pulp is important. Since the harbours along the coast are well situated for the importation of coal and other raw material, manufactures, especially of textiles, are growing in the coast towns of these states. *Reval*, on the Gulf of Finland, is the chief port and

the capital of Esthonia. It exports grain, flax, lumber, and hides, and imports manufactured articles. *Riga*, on the Gulf of Riga, is the capital of Latvia and before the revolution was one of the greatest Russian ports—next to Petrograd it is the greatest seaport on the Baltic. Its situation on the *South Dwina River* gives it direct boat connection by means of canals with the Dniester and Volga Rivers. *Vilna*, an old historic town, is likely to be the capital of Lithuania.

CHAPTER XXXVIII

FINLAND

Sec. 489.—Finland was one of the countries that arose from the wreck of Russia after the Great War. Although it is one of the largest countries of Europe, its northern position, its rocky and barren soil, and its inhospitable climate limit agriculture greatly, and the population is only slightly more than that of the Province of Ontario.

The farming is largely confined to the south, where rye, barley, and oats are extensively grown (Figs. 185 and 197). Dairy farming is also developing, and a good deal of butter is exported. In the more barren parts which are cleared, flocks of sheep find sufficient pasturage (Fig. 176).

Much of the country is covered with forests of pine and fir, and the chief exports are wood products. Lumber and pulp are the chief of these. As the winters are much like those of Eastern Canada, and the surface of the country abounds in rivers and lakes much like those in the northern parts of Ontario and Quebec, the lumbering operations in the two countries are much alike.

The inhabitants are Finns and Swedes. The Finns, who form the greater part of the population, are more closely related to the inhabitants of Central Asia than to the great races of Europe. At a very early period they migrated to the north-west of Europe. The Magyars of Hungary, who are closely related to the Finns, came from the same region in Asia. The Finns are short, stout, and with the slanting eyes and high cheek bones of the Asiatic. They have excellent schools, and all are educated.

The Swedes live chiefly along the coast of the Gulfs of Bothnia and Finland.

Helsingfors is the capital and the chief commercial town. In it is found the chief university of the country.

The country has a republican form of government.

CHAPTER XXXIX

RUSSIA

Sec. 490. Russian ports.—In spite of the fact that the Russian Republic has the Arctic Ocean along its whole northern border, the Pacific along its whole eastern border and the Black and Caspian Seas along the south, its lack of suitable seaports has always been a drawback. *Archangel*, on the White Sea, is icebound for five months of the year; *Vladivostok*, on the Pacific coast, is too far from the centre of population; *Odessa* and the other ports on the Black Sea have access to the Mediterranean Sea only through the *Dardanelles*, which, up to the close of the Great War, were under the control of Turkey; and even the ports on the Baltic Sea are icebound for several months during the year. This great country has had an ambition for several centuries to obtain a port with unimpeded access to the great sea routes at all seasons of the year. With the Dardanelles in the hands of the Allies that ambition is on the way to be realised, but on the other hand the separation of the new countries, Finland, Esthonia, Latvia, and Lithuania from her western side has robbed her of all her seaports in that district with the exceptions of *Petrograd* and *Cronstadt*.

Sec. 491. Surface and drainage. With the exception of the snow-capped *Caucasus* in the south all of European Russia is a great plain, any irregularities in which are due to the deep river valleys, which have been eroded by the streams (Map 33 in Atlas). In such an extensive plain there are many long rivers with meandering courses. Because the country through which they flow is so level, the rivers and their tributaries are navigable for the greater part of their courses. On account of the light rainfall of Russia, especially during the summer, the water becomes so low that during this season and autumn navigation is difficult. As the most of the streams freeze over during the winter, navigation is impossible at this season. But in spite of all these shortcomings the rivers are of the greatest value both for shipping and lumbering, especially as roads are very bad and railways are not numerous in many parts. The *Volga*, which is by far the largest river in Europe, rises south of Petrograd in the *Valdai Hills* and empties into the Caspian Sea. The *Don* is the most important Russian river emptying into the Black Sea.

Sec. 492. Climate and vegetation.—The westerlies from the Atlantic Ocean have lost much of their moisture by the time they reach Russia, and the land is so devoid of mountains, which might deflect the wind upward and thus cause its moisture to condense, that there is too small a rainfall in all parts of Russia (Map 37 in Atlas). Toward the south the precipitation diminishes so greatly that desert conditions are present along parts of the Caspian Sea.

As the greater part of Russia is far from the ocean, its tempera-

FIG. 196. RELATIVE SIZES OF RUSSIA AND CANADA

How many times as large as Russia is Canada?

tures are extreme, warm in summer and cold in winter (Maps 35 and 36 in Atlas). Indeed, they are not unlike those of Ontario and Quebec. The severity of the winters increases towards the east.

The belts of vegetation are much like those that run across Canada (Map 38 in Atlas). Along the north is a *tundra* region covered with moss and lichen. Farther south is a belt of evergreen forest, which contains the pine and spruce, the most important timbers in Russia. This coniferous forest is gradually replaced in the south by the hardwood forests. As the climate toward the south and east becomes drier, the forests give place to the grasslands of the Russian steppes.

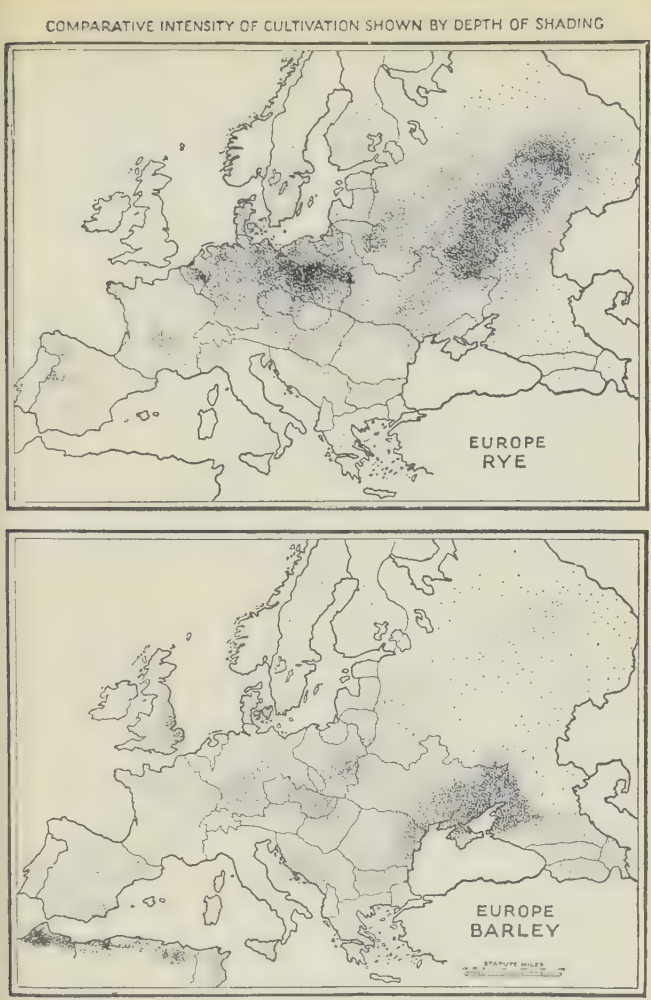


FIG. 197. DISTRIBUTION OF RYE AND BARLEY IN EUROPE

What countries raise most rye? Where is the great barley-producing area of Europe?

Sec. 493. Agriculture.—Although at the present time agriculture is at a low ebb in Russia, the fact that before the war she produced more wheat, oats, rye, barley, flax, and hemp, and reared more cattle, horses, and sheep than any other country in Europe is a good indication of her predominant position in agriculture (Figs. 73, 175, 176, 185, 197, and 208). The great production is due to the large area of arable land and to the large agricultural population and not to the skilful agriculture of the Russian, for he is a very poor farmer. His holding is only a few acres, his tools out of date, and his cultivation crude and unscientific. His backwardness is largely due to the fact that he has been down-trodden and poverty-stricken for centuries, largely owing to bad government. Wheat, barley, and corn are grown in the fertile black-earth belt in the south, rye, oats, flax, and hemp in the less fertile centre and Baltic region.

Sec. 494. Fishing, lumbering, and mining.—The many fast days of the Russian Church demand a good supply of fish. In the White Sea are caught herring, in the Baltic Sea are obtained several kinds of fishes, but in the Caspian Sea and the rivers flowing into it are obtained the greatest variety and quantity of fishes. From this region alone are obtained more than four times the quantity of fish caught in the Great Lakes of Canada.

Russia is the greatest lumbering country in Europe. Besides the softwood and pulp of the north, valuable hardwoods are obtained from the deciduous forests of the centre and west.

There are three mining regions in Russia. In the extreme east in the *Ural Mountains* are obtained iron and some of the rarer metals, including most of the platinum used in the world. South of *Moscow* are some important coal mines. But the most valuable mines are north of the *Sea of Azov*, where iron and coal mines are worked extensively close together. The most important oil wells in Europe are on the west side of the Caspian Sea in the vicinity of the city of *Baku*.

Sec. 495. Manufacturing.—Manufacturing requires large expenditure of money, skilled workmen, good transportation, and abundance of coal. In all these respects Russia is not well equipped. *Moscow*, the capital, which is near one of the coal fields, is the centre of the chief manufacturing region. Cotton and linen goods are the main output of the region. The raw cotton is brought up the Volga from the region beyond the Caspian Sea, where it is grown in sheltered, irrigated river valleys. The linen comes from the flax grown in great quantities in the region to the west of Moscow. In *Petrograd*, the former capital, is produced a great variety of manufactured articles. In the farmers' homes in the villages during the long winters when there is little to do in the

fields much home manufacturing is carried on. *Odessa,* on the Black Sea, is the port from which much of the wheat of the south is exported.

A large region to the east of Poland, called the *Ukraine,* has separated from Russia, but the condition is so unstable that at present it need not be considered separately.

CHAPTER XL

SPAIN AND PORTUGAL

Sec. 496.—The *Iberian Peninsula*, which is divided into Spain and Portugal, has an area almost twice as great as the British Isles. Though washed by the Atlantic Ocean on three sides and by the Mediterranean Sea on the fourth the shipping of Spain and Portugal is almost negligible. The plateau that covers the greater part of the peninsula towers so close to the coast that there are few indentations to make harbours, and the ascent from the coast to the plateau is so steep that roads and railways are difficult to build. Indeed, there is no railway that completely crosses the peninsula either from east to west or from north to south.

FIG. 198. RELATIVE SIZES OF THE IBERIAN PENINSULA AND QUEBEC

The area of Quebec is about 700,000 square miles. What is the area of the Iberian Peninsula? What are the relative sizes of Spain and Portugal?

Sec. 497. Surface.—The north and south borders of the Iberian Peninsula are buttressed by two of the highest ranges of mountains in Europe (Map 33 in Atlas). In the north stand the Pyrenees, which form a natural border between France and Spain, and in the south the Sierra Nevada, whose snowy peaks extend over two miles into the clouds. Each of these ranges is separated from the central plateau by a fertile plain, the plain of the *Ebro River* in the north and the plain of the *Guadalquivir River* in the south. The central plateau is roughened by ranges of mountains running from south-west to north-east.

Sec. 498. Minerals. Although Spain has a greater variety of mineral wealth than any other country in Europe, its mines are developed only to a slight extent. This is largely due to the lack

of facilities for transportation and to the poor business ability of the people. Iron, the chief mineral, is exported in large quantities from *Bilbao* in the north to Britain. One of the oldest copper mines in the world is found in the south: and mercury, lead, and silver mines are worked to a considerable extent. Coal in small quantities is mined in the north, which is the most progressive part of Spain.

Sec. 499. Rivers.—As the most of the rivers tumble in a series of rapids and waterfalls over the edge of the interior plateau, they, with the exception of the Guadalquivir, are of little value for navigation. Moreover, as they run through deep chasms they offer serious obstacles to the building of railways at right angles to their directions.

Sec. 500. Climate.—It would naturally be thought that a region like the Iberian Peninsula, which is almost surrounded by water, would have an oceanic climate (Sec. 49). But such is not the case. The high ramparts of the plateau, extending as an escarpment almost to the coast, prevent the ocean breezes from penetrating into the interior, and as a result the climate on the plateau is continental rather than oceanic, hot in the summer and cold in the winter (Maps 35 and 36 in Atlas). During the winter the prevailing winds are from the Atlantic Ocean and bring sufficient rainfall to the western coast. But even the winter rains diminish toward the interior, and much of the Mediterranean coast receives almost as little rain as the Sahara Desert. The north-western part is in the region of the westerly winds throughout the year and has a rainfall and weather much like those of the south of England. Indeed, it is the only part of the peninsula to receive sufficient rain to produce forests of deciduous trees like those in the eastern part of Canada. In other parts there is desert, grassland, or forests of thick-leaved evergreen trees interspersed with spiny shrubbery.

Sec. 501. Agriculture. The cereals, wheat, corn, oats, and barley, are grown in many parts of the peninsula (Figs. 185, 197, and 200), but the Spaniards are not first class farmers and in many parts use such crude instruments as a pointed wooden stake for a plough; but their methods have begun to show improvement during recent years. The vine is grown in many parts, and the port wine, which is exported from *Oporto* at the mouth of the *Douro River* in Portugal, and the sherry wine, which comes from the valley of the Guadalquivir in the south, have long been famous. Olive trees, which flourish in semi-arid climates, are grown in great numbers in the valleys of the Guadalquivir and Ebro and also on many parts of the plateau (Fig. 200). Many parts of the plateau are better adapted for grazing lands than for producing crops, and many herds of cattle and flocks of sheep are reared (Figs. 175 and 176).

All of the crops so far mentioned are grown without irrigation, but along the Mediterranean coast is found one of the most elaborate systems of irrigation in the world. Terrace after terrace rises from the coast to the plateau. On these terraces are grown oranges, lemons, almonds, raisins, and figs. The city of *Valencia* is the chief centre for the export of much of this fruit, and Valencia oranges and Valencia raisins are notable for their good quality (Fig. 76).

Sec. 502. Manufactures.—Spain's manufactures are centred in two regions. *Barcelona* in the north-east has a good harbour, and its people, the Catalans, are more energetic and progressive than those of other parts of Spain. They manufacture large quantities of cotton, linen, and silk fabrics. In the region of Bilbao, where most of the coal and much iron is mined, large and growing manufactures of iron goods have developed. Olive oil and soap, for the manufacture of which olive oil is used, are produced in the regions in which the olive is extensively grown. But owing to the indifference of the people, their poverty, the poor transportation, and unsettled government, manufacturing is backward.

Madrid, the capital of Spain, is not a manufacturing city, but owes its growth largely to the fact that it is the political and railway centre of the country. *Lisbon*, the capital of Portugal, has a much better situation for commerce than has Madrid. It is a seaport at the mouth of the *Tagus*, and is entered by five important railways.

Sec. 503. Colonies.—Spain, which at one time had the greatest colonial empire in the world, as the result of bad government, has been stripped of all her territorial possessions with the exception of a small part of Morocco and the Canary Islands. Portugal on the other hand has still large colonies in Africa, and has several groups of islands, *Cape Verde*, *Madeira*, and the *Azores* in the Atlantic. She also has possessions in India and the East Indies.

Sec. 504. Gibraltar.—The rock of Gibraltar projects as a tongue-like peninsula from the south of Spain into the Strait of Gibraltar. It is a very strong British fortress, which guards the Strait. Thousands of steamers coal in its harbour every year.

CHAPTER XLI

ITALY

Sec. 505.—The peninsula of Italy, stretching like a boot out into the Mediterranean Sea, has played a great part in the history of the world. Protected by the sea on three sides and the majestic Alps on the fourth, she developed a high state of civilization two thousand years ago, and her wonderful language, Latin, and her excellent laws, as well as many of her forms of government, have influenced every great nation in the world.

Sec. 506. Coasts.—The very extensive coastline on the Mediterranean Sea, which has long been the centre of the civilized world, has made the Italian ports of great importance. The products of Southern Asia, East Africa, and Australia are landed at *Venice* and *Genoa* and taken through the low passes of the Alps to supply the needs of Central Europe, which is the most densely populated part of the continent. Although the coastline is so extensive, there are few good harbours on either the east or west coasts, because the mountains come too close to the coast on the east and the volcanic mud on the west coast tends to silt up the mouths of most of the inlets.

FIG. 199. RELATIVE SIZES OF ONTARIO AND ITALY

The area of Ontario is about 400,000 square miles. What is the area of Italy?

Sec. 507. Surface.—The Alps, the highest mountains in Europe, skirt Italy on the north, swing south between it and France and are continued along the peninsula as the Apennines Mountains right to the tip of the island of Sicily (Map 33 in Atlas). Along the west coast is an ancient range of mountains, which is very low and much broken as it has been worn down to its very roots. In this range are a number of volcanic cones, one of which, *Vesuvius*, is the most celebrated active volcano in the world.

Lying between the Alps and the northern part of the Apennines is one of the most fertile and most densely populated plains in the world. Its soil is composed of the delta deposits of the River Po, which runs through it from west to east, and by glacial deposits carried down from the Alps during the glacial period. Along the peninsula between the Apennines and the sea are plains of varying widths.

Sec. 508. Transportation.—With the exceptions of the Po in the north and the *Arno* and *Tiber* on the west the rivers are short streams that tumble down in rapids and waterfalls from the Apennines to the Adriatic Sea on the east and to the Mediterranean Sea on the west. The Po is navigable as far as *Turin* for small boats, the Arno as far as *Florence*, and the Tiber as far as *Rome*.

Although railway building is difficult on account of the mountainous character of most of the country, yet lines run along both sides of the peninsula, and the valley of the Po is well networked with them. No less than four now pierce the Alps and connect Italy with the dense populations of Central Europe.

Sec. 509. Climate.—As the barrier of the Alps cuts off the cold winds from the north, it is possible to grow oranges around Genoa and olives at the base of the Alps. The close proximity of all parts to the sea gives most parts of the country a delightful climate. Only in the higher parts of the Apennines is very cold weather experienced. As would be expected in a long narrow peninsula, highest toward the centre, there is a fair amount of rain, which is most abundant in the north where the moist winds are chilled by the high Alps. But the rainfall is not so well distributed in time, since unfortunately it is most abundant during the autumn and winter (Maps 3 and 4 in Atlas). Consequently, in order to grow summer crops in many parts of the country, irrigation is necessary.

Sec. 510. Agriculture.—Italy is pre-eminently an agricultural country, and the dense population cultivate intensively every inch of arable land. It is no uncommon sight to see three crops growing in the same field. Between the rows of olive trees is planted corn, and grape vines find support on the trunks of the olive trees. Wheat and corn are the chief grain crops (Figs. 185 and 200). Italy enjoys the distinction of being the only country in Europe which grows rice extensively. Olives, oranges, lemons, and grapes are all important (Figs. 76 and 200). In the irrigated fields of the valley of the Po River as many as ten crops of hay in as many months are grown, and this forms excellent fodder for the dairy herds for which this region is celebrated (Fig. 175).

Sec. 511. Mining and manufacturing. As the Alps and the Apennines are two of the youngest mountains in Europe, and erosion has not yet laid bare their roots in which veins form, Italy

is very deficient in minerals. Coal is entirely lacking and the only iron mines are confined to the small island of *Elba*. Sulphur, which is found in Sicily, is the only important mineral product.

Though Italy has an abundance of cheap, intelligent labour, the lack of coal and iron has handicapped her manufacturing. Nevertheless, in recent years she has done wonders. In the towns of the north, silk, linen, hemp, cotton, and woollen fabrics are all made in large quantities. Indeed, *Milan* has wrested from Lyons in France the first place in the silk trade. Fine straw hats are

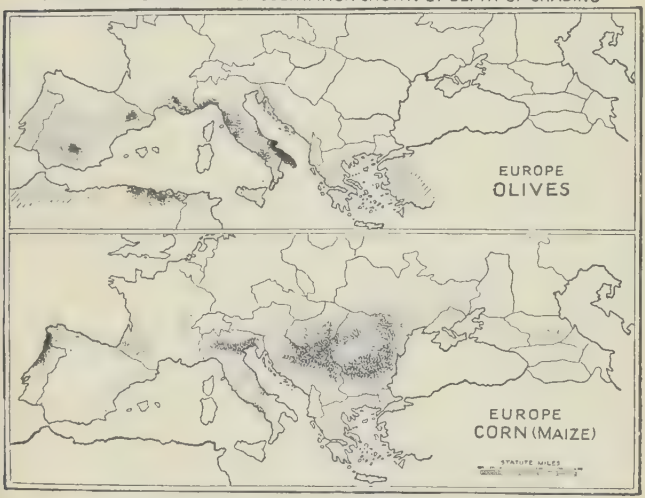


FIG. 200. DISTRIBUTION OF CORN AND OLIVES

Notice that both require mild climates. What countries produce large quantities of olives? Where are the corn-producing areas?

braided from the long, thin wheat straw, which is grown along the west coast near *Leghorn* and the beautiful city of *Florence*. Italy, the mother of the fine arts, is also famous for the manufacture of artistic articles of glass, coral, marble, earthenware, and lace.

Now Italy is beginning to develop her important water-powers, and undoubtedly this will greatly assist her industry.

Sec. 512. Cities.—Rome, the capital of Italy, is perhaps the most notable city in the world. Its importance has always been political rather than commercial. It was the capital of the great Roman Empire, and, because it is the home of the Popes, has always been

the holy city of the Roman Catholic church. *Naples* on the west coast south of Rome is the largest city in Italy. On the Gulf of Naples it has the most beautiful situation of any city in Europe. Milan, the second city in size, is the great industrial centre of the north. Venice at the head of the Adriatic, and Genoa on the opposite side of the peninsula are important points for the transportation of goods from the Mediterranean to Central Europe. *Florence* is the art centre of the country.

CHAPTER XLII

SWITZERLAND

Sec. 513. Surface.—The little republic of Switzerland is hemmed in among three of the most powerful countries of Europe, namely Germany, France, and Italy, but among all the conflicts she has managed, during six centuries, not only to retain her independence, but to enlarge her territory greatly.

Switzerland is the highest country in Europe. The greater part of its area is occupied by the highest ranges of the massive Alps. *Mount Blanc*, the highest peak on the continent, is in the south, and *Mount Rosa*, only five hundred feet lower, is a little farther east. Both are on the border, the former between France and Italy, the latter between Italy and Switzerland.

Many of the valleys running north and south from the main crest have had their lower courses blocked with boulder clay during the glacial period and are now occupied by very beautiful lakes. *Lake Geneva* drained by the Rhone River and *Lake Constance* drained by the Rhine River are the most noted.

Sec. 514. Industries.—In the valleys (Fig. 201) cereals and potatoes are being rapidly replaced by hay, which is used to feed the dairy herds during the winter. Throughout the summer these herds are led into the high valleys above the tree line, where there are rich pastures. The milk is largely used for making the famous Swiss cheese.

In the north and west parts of the country the numerous water-powers are used in the manufacturing of silk, woollen, and cotton fabrics. Swiss watches and clocks, the trade in which centres in *Geneva*, are known the world over for their fine workmanship.

As Switzerland is surrounded by the densest populations in Europe, as the scenery of the mountains is unsurpassed anywhere in the world, and, further, as it is a favourite health resort both in summer and winter, the catering to the tourist trade is the most important industry in the country.

There are nō large cities. *Berne* is the capital.

FIG. 201. SWISS VILLAGE IN A VALLEY [*Courtesy of Swiss Federated Railways.*

Notice the mountains on each side, the flat valley between made of fertile, alluvial soil, washed down from the sides. A river runs through the far side of the valley.

CHAPTER XLIII

HUNGARY

Sec. 515.—The Great War was the means of reducing Hungary to one-half of its former size (Fig. 202). The south-western part

FIG. 202. THE NEW AND OLD BOUNDARIES OF HUNGARY

The heavy line is the present boundary of Hungary. The heavy dotted line marks the boundary of Hungary before the Great War. What fraction of her area has Hungary lost?

was given to Jugo-Slavia, and Hungary was cut off from the Adriatic Sea. The mountainous province of *Transylvania* with its predominant Rumanian population was ceded to Rumania, while

the part in the Carpathian Mountains became a part of Czecho-Slovakia. Although Hungary lost both in area and population, it gained greatly by having its people become more uniform in race, religion, language, and ideals. The *Magyars*, a race which came originally from Asia and are more closely related to the Finns than to any other European people, now form the bulk of the population. Many groups of Germans, however, are planted like islands among the Magyars.

Sec. 516. Surface and drainage.—Hungary is for the most part a great plain (Map 33 in Atlas). Through it flows the Danube River, the second longest in Europe. This important river rises in the Black Forest of Germany, flows through one of the most

FIG. 203. COMPARISON IN AREA OF HUNGARY AND THE MARITIME PROVINCES

The area of the Maritime Provinces is 50,000 square miles. What is the area of Hungary?

densely populated parts of Europe, and empties into the Black Sea. As it is the only large and important river in Europe whose course runs east and west, it is of the greatest importance both historically and commercially. Along its valley has flowed almost every great invasion of Western Europe by the barbarian peoples of Asia, and along its valley marched the crusaders in their overland journey to the Holy Land. As, by the deepening of channels, the blasting of rocks, and the reduction of curves, extending over hundreds of years, it has been made navigable from its mouth almost to its source, a very large amount of the commerce of Hungary is transported by ships along its stream, and now that this country has lost direct access to the Adriatic Sea its shipping on the Danube is bound to increase.

Sec. 517. Industries.—As the summers are warm, the rainfall light, the surface level, and the soil fertile, corn and wheat are the

principal cereals grown (Figs. 185 and 200), and the chief part of the population is engaged in carrying on this kind of farming.

Because the mineral wealth of the country was transferred to Rumania with Transylvania, mining is no longer an important industry of Hungary.

The converting of wheat into flour, the distilling of liquors, and the manufacturing of sugar from sugar-beet, which is being produced in increasing quantities, are the chief manufacturing operations of this intensely agricultural country.

Sec. 518. *Budapest*, the capital, is the only important city. It is situated on the Danube River just below a gorge, which this river has cut across a range of mountains, and it thus has a position very important from a military standpoint. It is the centre of both commerce and manufacturing. Moreover, it forms the focus for the culture, social life, and education of the whole Magyar people.

CHAPTER XLIV

RUMANIA

Sec. 519.—The Rumanian people have a remarkable history. During the reign of the Roman Emperor Hadrian large colonies of Romans were placed along the Lower Danube to guard the eastern borders of the Roman Empire. The Rumanians are the descendants of these people and more nearly resemble in speech and appearance the people of Italy than their neighbours. Of course they have mixed a good deal with the surrounding peoples, and have many Slavonic characteristics and customs.

FIG. 204. CHANGE IN AREA OF RUMANIA SINCE THE GREAT WAR

A heavy line marks the boundary before the Great War, broken lines the boundaries of the area added.

Sec. 520. Present extent.—After the Great War the boundaries of Rumania were so largely extended that from being one of the small nations of Europe it has suddenly become one of the large ones (Fig. 204). It is now larger than the British Isles, about the same size as Norway, and much larger than Austria and Hungary together. From Hungary she obtained the mountainous province of Transylvania and the fertile province called the *Banat*; from Russia, Bessarabia on the east; and from Austria, Bukovina, which rounds off her area in the north. As in Transylvania and Bessarabia the great majority of the people are Rumanians, their union with Rumania can be justified on national grounds.

Sec. 521. Surface.—The southern and eastern parts are continuations of the great Russian plain, but Transylvania is bordered on the south and east by the rounded, grassy tops of the Carpathians and Transylvanian Alps. The Danube on the south receives the chief rivers, which rise in the Transylvanian highlands, cut deep gorges into their slopes, and flow south and east.

Sec. 522. Industries.—Over eighty per cent. of the people are engaged in agriculture. Wheat and corn are the principal crops

(Figs. 185 and 200). While most of the wheat is exported, the corn forms the chief food of the peasants. Oats and barley are of some importance, and the growing of tobacco and sugar-beets is making great strides.

The slopes of the mountains are still covered with forests of oak, beech, fir, and pine. As the logs and lumber can be readily brought down to the Danube, Rumania has a very important trade in lumber.

In the Transylvanian highlands are the most important gold mines in Europe, and silver in small quantities is also obtained in the same region. South of the Transylvanian Alps are some of the most important petroleum wells in Europe. Salt is also extensively mined.

Manufacturing has made little progress, as the country has been very poor, has had unsettled government, and only fair transportation facilities. What industries there are depend on the farms for their raw materials. Flour mills, distilleries, and breweries are the most important manufacturing establishments.

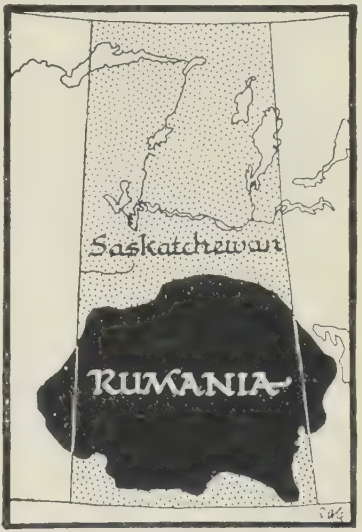


FIG. 205. RELATIVE SIZES OF RUMANIA AND SASKATCHEWAN

The area of Saskatchewan is 250,000 square miles. What is the area of Rumania?

Sec. 523.—*Bucharest*, the capital, is the largest and most important city. It is the political, social, and educational centre and has a more western appearance than most of the cities of South-east Europe. It has railways spreading out from it to the north, south, east and west. *Galatz* is at the head of sea navigation on the Danube River.

CHAPTER XLV

THE BALKAN STATES

Sec. 524. The Balkan States, including Greece, Bulgaria, Jugo-Slavia, and Albania, contain more diverse races, languages, nationalities, and religions than any other part of Europe. This is explained by the remarkable position of the Balkan States between Europe and Asia Minor on the one hand and between Eastern and Western Europe on the other. Many a tide of barbarian invasion from the plains of South-eastern Europe passed through the Balkans on their migration to Western Europe, and more than once Asiatics crossed the Bosporus to invade Europe. At this crossing place of the invasion-paths from east to west and from south to north many tribes were left in the valleys, and there retained their languages and habits for centuries.

Sec. 525. Surface.—The Alps of Austria turn south-east, follow the east side of the Adriatic Sea, and can be traced to the extreme south of Greece (Map 33 in Atlas). They send out a branch to the east, called the *Balkan Mountains*. There are many cross ranges of mountains throughout the Balkan States, and between these are river plains in which the bulk of the population live by cultivating the fertile valleys and grazing their flocks of sheep and goats and their herds of asses on the rougher slopes of the bounding hills. The largest of these plains is along the valley of the Danube River.

With such complicated networks of mountains, transportation has always been very difficult in the Balkans. The chief routes from north to south and from east to west are along the river valleys, and the railways, which are not numerous, follow the courses of the rivers. Roads are few and bad.

Sec. 526. People. The numerous tribes that have held the valleys have carried on feudal warfare for many centuries, and in no part of Europe has there been so much bloodshed. As a result the people have always been poor, ignorant, cruel, and badly governed. The blighting rule of the Turk during the last century has intensified the poverty, treachery, and depraved condition of these unfortunate people.

Sec. 527. Jugo-Slavia. This new country, which was formed after the Great War, is composed of Serbia, Montenegro, and several provinces formerly forming parts of Austria and Hungary.

The people are very largely of the Slav race and are closely related to the Poles and Russians. Jugo-Slavia is one of the large countries of Europe. The people are engaged chiefly in tilling the soil and in grazing sheep, goats, and asses. Corn and wheat are the most important cereals (Figs. 185 and 200); corn is the chief food of the common people, but the wheat is exported in large quantities. Plums are an important crop and are either dried to make prunes,

FIG. 206. CHANGE IN AREA OF GREECE SINCE THE GREAT WAR

Heavy lines mark the boundaries before the Great War, broken lines the boundaries of the area added.

or the juice is fermented to form plum brandy, the national drink of the Serbs.

Belgrade, the capital, is situated on the *Save River*, at its juncture with the Danube. *Fiume* on the Adriatic Sea is the chief port for Jugo-Slavia, though it is not in reality a part of the country. After the Great War, on account of the rival claims of Italy and Jugo-Slavia, it was made a free town with its own independent form of government.

The people of Jugo-Slavia are brave and hardworking, but cruel and revengeful.

Sec. 528. Greece.—After the World War Greece had a greatly increased area, but she has since lost largely in both Europe and Asia (Fig. 206). The part of Bulgaria bordering on the *Ægean Sea* and a considerable part of European Turkey were ceded to Greece. Some Turkish and Italian Islands in the Ægean Sea were added to her empire. As these islands are inhabited by Greeks, and as there are numerous Greek settlements, including the seaport of *Smyrna*, around the border of Asia Minor, the Ægean has now become a Grecian sea.

FIG. 207. RELATIVE SIZES OF GREECE AND MANITOBA

The area of Manitoba is about 250,000 square miles. What is the area of Greece?

The Greeks are the most progressive of the Balkan nations. Their country, cut up into peninsulas and coastal islands, has developed a sea-faring people, who have become great traders and have spread far and wide, so that to-day they form the chief traders on all the islands of the Ægean Sea, and along the Ægean and Black Sea coasts of Asia Minor. In the plains between the mountains of Greece the chief occupation is farming. Besides wheat and corn, grapes, olives, and currants are grown. Of the latter fruit Greece supplies more than all the rest of the world put together.

Athens, the capital and chief political and social centre, is one of the most celebrated cities in the world on account of its ancient greatness. *Salonica* is the chief seaport on the north coast of the Ægean Sea, and through it passes a large part of the trade of the adjoining part of the Balkans.

Sec. 529. Bulgaria, the most easterly of the Balkan States, lost all her territory bordering on the Ægean Sea after the Great War and her only ports are now on the Black Sea. Her people are farmers and herdsmen. The farming is carried on chiefly in two river valleys, the northern one being that of the Danube. Here corn and wheat are the staple cereals (Figs. 185 and 200).

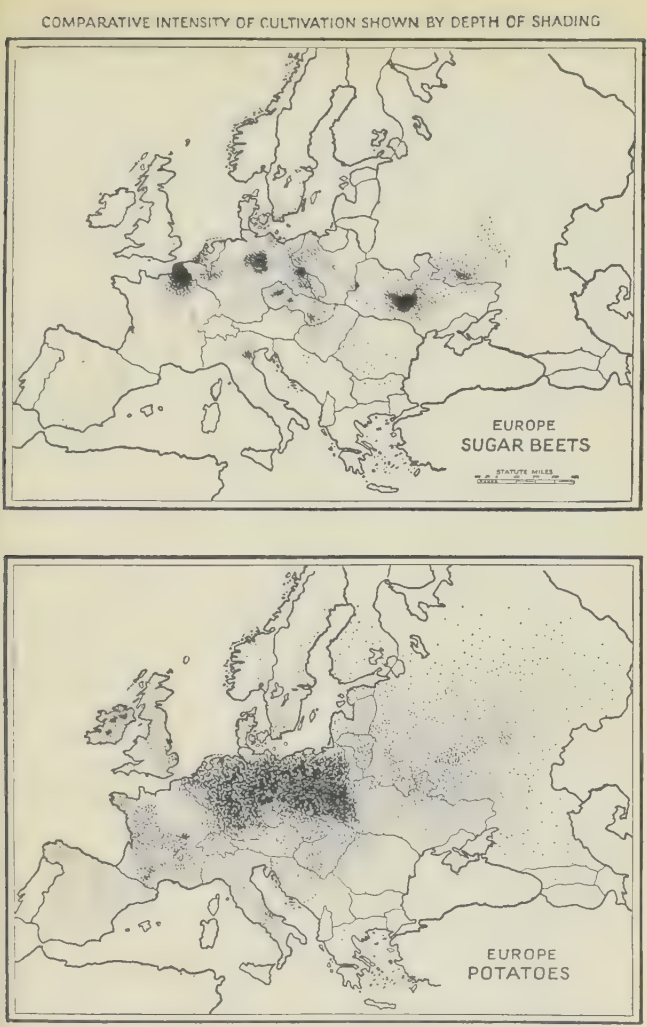


FIG. 208. DISTRIBUTION OF POTATOES AND SUGAR-BEETS IN EUROPE

What are the four chief sugar-producing countries of Europe? What countries produce most potatoes?

In the southern valley the climate is much milder, and olives, mulberry trees for the rearing of silkworms, and rice are produced. Hundreds of acres of roses are grown from whose flowers are extracted the beautiful perfume, attar of roses. Though the farmers are hardworking they use very simple implements, but their methods are improving, and they are as steady a people as are found in the Balkans. There are no large cities. *Sofia*, the capital, guards one of the most important trade routes in South-east Europe.

CHAPTER XLVI

ASIA

Sec. 530. Area and Boundaries.—We now come to Asia, the greatest in area of all the continents. It is almost six times as large as Canada, as large as Europe and North and South America combined, and covers about one-third of the total land surface of the globe.

Europe is so intimately connected with this great continent that they are in reality one, which is often called Eurasia. The north, east, and south coasts of Asia are washed by the Arctic, Pacific, and Indian Oceans respectively. On the west are the *Red Sea, Isthmus of Suez*, Mediterranean Sea, and the Ægean Sea, the waters connecting the Ægean and Black Seas, the Caspian Sea, and the Continent of Europe.

Sec. 531. Divisions.—Map 46 in the Atlas indicates clearly the main political divisions of Asia. On the north is *Siberia*, which includes the region east of the Caspian Sea, called *Turkestan*. The most western part of Asia, which was formerly a part of the Turkish Empire, has now been partly divided into countries, which have been placed under the protection of the Great Powers. Turkey retains the greater part of Asia Minor, including Armenia. *Syria* is under the control of France, *Palestine* is under the control of Britain, *Mesopotamia* becomes an Arab Kingdom, and *Western Arabia* is now ruled by the King of the Hejaz. Both of the latter are allies of the British. *Persia* and *Afghanistan*, two very backward countries between Arabia and India, are independent monarchies. *India*, which now includes *Burma*, is the most populous part of the British Empire. To the east of British India is *Siam*, an independent kingdom, and *French Indo-China*, consisting of several colonies and protectorates of France. In the Malay Peninsula are a number of small states, the chief of which are British colonies. The *Malay Archipelago* is a group of islands, which are colonies of different European countries. To Holland belong *Sumatra, Java, Celebes*, the *Moluccas*, the south-eastern two-thirds of *Borneo*, and the western half of *New Guinea*. To the United Kingdom belong the north-western portion of Borneo, the eastern half of New Guinea, the *Bismarck Archipelago*, and the *Solomon Islands*. To the United States belong the *Philippine Islands*. Between Siberia on the north and India and French Indo-China

on the south lies the great *Republic of China*. The *Empire of Japan* consists of a row of islands extending along the eastern side of Asia from *Formosa* in the south to the *Kurile Islands* on the north. In 1910 the peninsula of *Korea* was annexed by Japan.

Sec. 532. Coast.—Asia has a more irregular coast-line than any other continent except Europe. Along the south the three great peninsulas of Arabia, India, and Indo-China have the *Arabian Sea* with its extension the *Persian Gulf*, and the *Bay of Bengal* lying between them. On the east side of the continent are the *China Sea*, the *Yellow Sea*, the *Sea of Japan*, and the *Sea of Okhotsk*. To the east of Asia a partly submerged mountain chain runs from north to south through the Pacific Ocean, the unsubmerged parts of which form the *Kamchatka Peninsula*, the Kurile, Japanese, and Philippine Islands, and Borneo.

Sec. 533. Surface.—The outstanding feature of the surface of Asia is the great plateau, which extends from Asia Minor to China and Siberia (Map 44 in Atlas). In the west it is called the *Tableland of Asia Minor*, which gradually rises from the west to the east, and in Armenia, where it is called the *Armenian Knot*, it has one peak, *Ararat*, over seventeen thousand feet high. In Persia and Afghanistan it widens out into the *Plateau of Iran*, which on the south comes right down to the coast and in the north is skirted by a range of high mountains bordering the south shore of the Caspian Sea. A remarkable constriction of the plateau occurs to the east of Afghanistan, but north of India it again expands into a wide plateau, called the *Pamirs*, which is so high that it has been called the "roof of the world." East of the Pamirs the plateau widens to occupy more than half the breadth of Asia from north to south, but it is not uniformly high throughout its width. In the south it forms the *Plateau of Tibet*, which has an elevation ranging from fourteen to seventeen thousand feet and covers a very large area in Central Asia. Tibet is buttressed on the south by the greatest mountain range in the world, the *Himalayas*, one peak of which, *Everest*, reaches an altitude of twenty-nine thousand feet, the greatest height to which any peak extends. Just north of Tibet in *Chinese Turkestan* the plateau has a remarkable depression, a large area of which is less than three thousand feet high (Map 44 in Atlas). To the north of this depression the plateau again becomes high and here is called the *Thian Shan Mountains*. From the south-east of the plateau of Tibet a number of parallel ranges turn south and pass through Burma and Indo-China eastward. The Plateau of Tibet gradually passes into the lower and much dissected plateau of West China. The Thian Shan Mountains are continued north-eastward as a series of ranges which only terminate at *Behring Strait*. South of this series of ranges is the

FIG. 209. A CHINESE PAGODA [*Courtesy of Imperial Chinese Railways.*

One of these structures is built near every city to cause the wind and air to bring good luck. They are quite hollow, and contain no rooms or assembly halls. They have nothing to do with religious services.

dreary *Mongolian Plateau*, a large portion of which is occupied by the *Desert of Gobi*.

To the north of this central Asiatic plateau is the great Siberian plain, which is a continuation of the plain of Russia. It is widest and lowest in the region of the Caspian Sea, where it forms a depression below sea-level. Toward the east it becomes higher and narrower. Its general slope, as indicated by the rivers, is from south to north.

In the south the peninsula of Arabia, which is a tableland from two thousand to six thousand feet high (Map 44 in Atlas), is separated from the Plateau of Iran and the Tableland of Asia Minor by the alluvial plain of Mesopotamia. The plateau in the peninsula of India, called the *Deccan*, is separated from the Himalayas by the alluvial plains of India, which are largely composed of delta sediments from the Ganges and Indus Rivers. To the east of the Mongolian Plateau occurs the only other notable plain of Asia, called the Great Plain of China. This is also largely composed of delta sediments from the two great rivers of China, the Hwang-ho and the Yang-tsze-kiang.

Sec. 534. Climate.—In order to understand the climate of Asia one must keep in mind that it is the largest land mass in the world, that its central part consists of the broadest, highest plateau in the world, that almost the whole continent is north of the Equator, and that the great desert of North Africa is situated just to the west of it. During the summer the sun shines almost vertically on the great central plateau. Since the desert air is clear and rare, and since the region is many hundreds of miles from any great bodies of water, the air becomes very hot, and the plateau becomes a centre of low pressure (Map 48 in Atlas). Consequently, during this season the winds blow in toward Central Asia from the Indian Ocean on the south, the Pacific Ocean on the east, and from Europe and the Sahara Desert in Africa on the west (Map 4 in Atlas). The warm humid winds, blowing from the Indian and Pacific Oceans, make the climate of India, Indo-China, China, and Japan hot and sultry. The dry scorching winds from Africa make Arabia, Persia, and Afghanistan hot and arid. Siberia is also warm at this season of the year, for the prevailing winds are from the west, and since they have blown over the whole width of Europe, any moderating influence of the ocean is lost.

During the winter conditions are reversed. Now the sun is far to the south, and the slanting rays, short days, and high altitudes all combine to make Central Asia very cold, and a centre of high pressure. The winds blowing out in all directions from the high plateau cause low temperatures (Map 47 in Atlas). At this period India has her cool season, China has cold weather even in

its southern parts, and in Siberia the temperature drops lower than it does anywhere else in the world.

The rainfall depends largely upon the winds. India, Indo-China, China, and Japan are within the monsoon region. During the summer the hot, moist winds blow in from the Indian and Pacific Oceans. Wherever they are tilted by sloping land they produce heavy precipitation, and as a result all of these regions, except on the leeward sides of the mountains, have abundant summer rains (Map 4 in Atlas). Over Arabia, Persia, Afghanistan and the valley of the Indus River in India the winds blow, not from the ocean, but from the deserts of North Africa, resulting in this whole region being arid. In Siberia the prevailing westerly winds have precipitated most of their moisture in their passage over Europe, and when they reach Siberia are comparatively dry, so that the rainfall is meagre. Central Asia is so high and so far away from the ocean that the winds have shed all their moisture before reaching this region. During the winter the winds blow out in every direction from Central Asia. As this desert air is already dry it becomes still drier as it descends into the plains of India, Indo-China, and China, and almost the whole of Asia has little rainfall during this winter season (Map 3 in Atlas). As Siberia and the whole of the great Asiatic plateau from Asia Minor to China are cold during this season, most of the precipitation is in the form of snow.

Siberia

Sec. 535.—Siberia, a portion of the Russian Republic, is the largest country in the world, having an area greater than Canada by one-third. Until the trans-Siberian railway was constructed, its chief immigrants were political prisoners exiled by the Russian Government to work in the mines. The construction of this railway led to a great influx of Russian peasants, who have settled chiefly along the western part of the railway.

The climate of the western provinces is much like that of the Canadian Prairie Provinces, except that the rainfall in many parts is much less (Maps 47, 48, and 49 in Atlas). Wheat and oats are the chief cereals (Figs. 59 and 61), and cattle is the chief kind of stock. Dairying is also rapidly developing. Farther south through the dry plain between the Caspian Sea and the Pamirs flow several rivers, which are fed by the snows of the plateau and whose water is used for irrigation. Cotton is one of the chief crops raised by the settlements of farmers and shepherds now found in these river valleys (Fig. 72).

A large part of Eastern Siberia is not yet explored. It is known to be largely covered by forests, but on account of the difficulties of transportation not much lumbering has been carried on up to the present. The chief industry of this part of Siberia is mining, especially for gold. The fishing industry is important on the coast. Into the rivers emptying into the Pacific the salmon enter as they do in Alaska and British Columbia. However, the industry is largely in the hands of Japanese.

The rivers which drain Siberia rise in the great Asiatic plateau, flow across the plain, and empty either into the Arctic or Pacific Ocean. All are very long, but their frozen condition for almost half the year lessens their value for transportation. The *Amur* in the east, which empties into the Sea of Okhotsk, is navigable almost to its source. The *Lena*, *Yenisei*, and *Obi*, which empty into the Arctic Ocean, are all utilised for transportation.

The trans-Siberian railway, which has been already mentioned, begins to the east of the Ural Mountains, from which point it has railway connections with Moscow and Petrograd, passes across the southern part of Siberia, through Manchuria, a province of China, and terminates at the port of *Vladivostok* on the Sea of Japan.

Western Asia

Sec. 536. Asia Minor, which lies between the Black and Mediterranean Seas, is a low plateau with very narrow coastal plains. As the rains on these coastal plains fall in the winter, summer cultivation is carried on chiefly by irrigation. The cereals, wheat, corn, and barley, and such fruits as raisins, grapes, olives, figs, oranges, and lemons are the chief crops (Figs. 59, 61, 62, and 76). On the plateau, where there is much less rain, herds of the celebrated Angora goats are pastured. The fleece of this goat is called *mohair*, which is the chief fibre used in the weaving of the carpets made by the people of the plateau.

Sec. 537. Syria.—The region to the east of the Mediterranean Sea is called Syria. It includes in its southern part the land of Palestine, where Christ was born and lived, and where many biblical events occurred. The industries of Syria are similar to those of Asia Minor (Fig. 210). On account of the long period of misgovernment under the Turks both Syria and Asia Minor have not had the industrial development of which they are capable. Syria is now under the protection of France.

Sec. 538. Arabia. The peninsula of Arabia is about one-third the size of Europe, but on account of its arid climate there are few inhabitants. Most of the population are on the borders, which are

higher and cooler than the interior. The south-western part around *Mocha* is so high that it has sufficient summer rain to allow coffee to be grown. In the interior there are a few oases in which the people tend their flocks. Most of the dwellers of all these desert regions have to drive their flocks from place to place in order to obtain pasturage. Consequently they have no houses but live in tents. In Arabia are the two cities most sacred to Mohammedans, *Mecca* the place where Mohammed was born, and *Medina* farther north where he died and was buried. Both of these towns have magnificent mosques, and many Mohammedans make pilgrimages to them every year. The population of each is about fifty thousand. After the Great War, Western Arabia was placed under the King of the Hejaz.

In the south-west of Arabia near the *Strait of Bab-el-Mandeb* is the British town of *Aden*, which is an important coaling station and port of call. The island of *Perim* in the middle of the strait is another British possession of great strategic importance.

Sec. 539. Iraq, or Mesopotamia.—Lying between the Syrian Desert and the Plateau of Iran is the low alluvial plain of Iraq, which recently was made into an Arab Kingdom under the protection of the United Kingdom. From the earliest historical times this plain was the home of great nations. On account of its fertile soil, warm weather, and excellent system of irrigation the people were able to raise large quantities of food, even three crops of wheat being reported during a single year. With the coming of the Turks, the ruin of the irrigation dams and canals began, and now an avenue of continuous ruins more than a thousand miles long, which strew the banks of the Rivers *Euphrates* and *Tigris*, is a sad reminder of the thriving civilisations of the past. The ruins of the great city of *Babylon* are still to be seen on the Lower Euphrates and of *Nineveh* on the Middle Tigris.

These great rivers rise in the mountains of Armenia, first flow west as turbulent streams through canyons with sides more than a thousand feet high, then turn south-east, glide through a desert for a thousand miles, along which course they receive no affluents, and finally unite to form a single stream which empties into the Persian Gulf. The lower part of their courses is through a great plain composed of the finest sediment, which is really the delta deposited by their water.

Until it was captured by the British in the Great War the country near the river was covered with marshes choked with rushes, and the country farther back was a desert waste. Wild, robber bands of wandering Arabs made the district an unsafe dwelling place. Already under British rule a complete change has taken place. Order has been restored, the dwellers along the rivers are encouraged

FIG. 210. THE NEAR EAST, SHOWING THE DISTRIBUTION OF THE TURKISH EMPIRE AFTER THE GREAT WAR

The Bagdad railway is marked, the completed part being alternately black and white. What part of it is not completed?

to cultivate their crops, and the development of irrigation works has begun. It has been estimated that by suitable dams and irrigation canals many thousands of square miles of the most fertile land in the world can be brought under cultivation, and it is safe to predict that before many years this region will again be the home of a dense population of prosperous Arab farmers, and that the British regeneration of Mesopotamia will be as marvellous as that of Egypt.

The winters of the region are warm and the summers hot (Maps 47 and 48 in Atlas). Since the rainfall is very scanty (Map 49 in Atlas), the rivers depend on the melting of the snows of the Armenian mountains for their supply of water. At present the chief crops of the upper part of Mesopotamia consist of wheat, millet, and barley, which are used for food; and sesame, from the seeds of which a valuable oil is extracted. The chief product of the Lower Mesopotamia is dates (Fig. 78).

Sec. 540. Transportation Routes of Asia Minor, Syria, Arabia and Mesopotamia.—Throughout all of Western Asia there are few good roads suitable for wheeled traffic. The chief means of transportation is by great caravans, in which camels are the beasts of burden. Before the construction of the Suez Canal there were two important routes from India to Europe. One passed through the Red Sea and up the Persian Gulf, the other overland along the Euphrates River to the Mediterranean Sea. With the completion of the Suez Canal the latter route fell into disuse, but within recent years the famous *Bagdad railway* was undertaken and the route revived (Fig. 210). This railway, more than three-fourths of which is now completed, begins in the west near *Scutari* on the Strait of Bosporus, opposite Constantinople, strikes south-east to pass through *Aleppo* in Syria, then skirts the north of Mesopotamia to *Mosul* on the Tigris River, and follows this river to the historic city of *Bagdad*. From there it passes to the Persian Gulf. This route, when completed, will make the overland journey between Europe and Southern Asia very short. The seaport and great commercial city, *Smyrna*, situated on the west coast of Asia Minor and connected with the Bagdad railway, is the centre to which most of the products of Asia Minor are collected for export. Another branch from the Bagdad railway now passes south through Damascus to Medina and gives off a lateral to *Jerusalem*, in Palestine.

Sec. 541. Persia and Afghanistan.—These two states consist largely of plateaux, across which run valleys that by the assistance of irrigation are capable of being cultivated (Map 44 in Atlas). In these valleys are grown wheat, rice, cotton, many sub-tropical and temperate fruits, and tobacco (Map 45 in Atlas). On the

higher parts agriculture gives place to pastoral pursuits, and flocks of camels, cattle, sheep, and goats are the chief wealth of the country. Where the regions are arid the shepherds are nomads, moving from place to place according to the season in order to obtain suitable pasturage. The only mineral of interest is petroleum, which is obtained in the south-west, the chief field being under the control of the British Government, who purchased it in order to have a supply of liquid fuel for their warships. The principal manufactured articles are carpets, leather, and soap, all of which are made in the home and not in the factory.

The best roads are found in the north, and consequently the chief trade in the past has been with Russia rather than with India. But with the collapse of Russia and a treaty between Great Britain and Persia trade was being rapidly deflected to the south. Persia, however, has recently renounced the treaty.

British India

Sec. 542. Importance.—British India has about one-half the area of Canada or Europe (Fig. 211), but its population is twice as large as that of North and South America together, and almost as large as that of Europe. Indeed, it is probable that its population equals if it does not surpass that of China. In its agricultural productions, both in variety and quantity, it is unsurpassed by any country in the world with the possible exception of the United States. When it is stated that in the production of such important staples as tea, rice, jute, indigo, millet, and cattle it stands first, and in the production of wheat third, one can understand the wonderful resources of the country. But it must not be forgotten that in spite of its immense resources, the population of India is so great, that a large part of the products is required by the people themselves, and that of some of the above commodities, little or none is left for export. Moreover, the great majority of the people are very poor, live on very small plots of land, and have very few of the comforts of life.

Sec. 543. The Indo-Ganges Plain.—The surface and climate were described in Secs. 533 and 534, and it is only necessary to add a few details. The Plain of India lying between the Himalayas and the Deccan Plateau is exceedingly fertile. So fine is the soil that one could traverse this plain from the delta of the Ganges to that of the Indus without finding a single pebble. The amount of rainfall increases from the valley of the Indus, where there is practically none, to the Ganges and beyond, where several hundred inches of rain fall during the wet season (Map 49 in Atlas). In the

drier parts of the north-east, wheat, millet, and cotton are the chief crops, and in the wetter parts rice, jute, and tobacco (Figs. 212 and 213). The chief food of the people in the dry regions is millet, and in the wet regions rice.

Sec. 544. Southern Peninsula.—A narrow plain along the west coast is backed by a high range of mountains, the *Western Ghats*, and a wider plain on the east coast is backed by an escarpment, which is the eastern edge of the plateau of the Deccan between

FIG. 211. RELATIVE SIZES OF BRITISH INDIA AND CANADA

the two coastal plains (Map 51 in Atlas). As the Deccan is highest on the west and gradually slopes toward the east, most of the rivers in the peninsula rise near the western coast, flow across the plateau and empty into the Bay of Bengal. The rainfall on the western coastal plain is very heavy (Map 49 in Atlas), but since the plateau is on the lee side of the Western Ghats, the south-west monsoon does not bring it much rain. The eastern coastal plain receives moderate rainfall in the summer and is one of the few parts of India which receive winter rains as well. Rice and tobacco are the staple crops of the wet coastal plains, and cotton is the most important crop of the Deccan, whose black soil is particularly

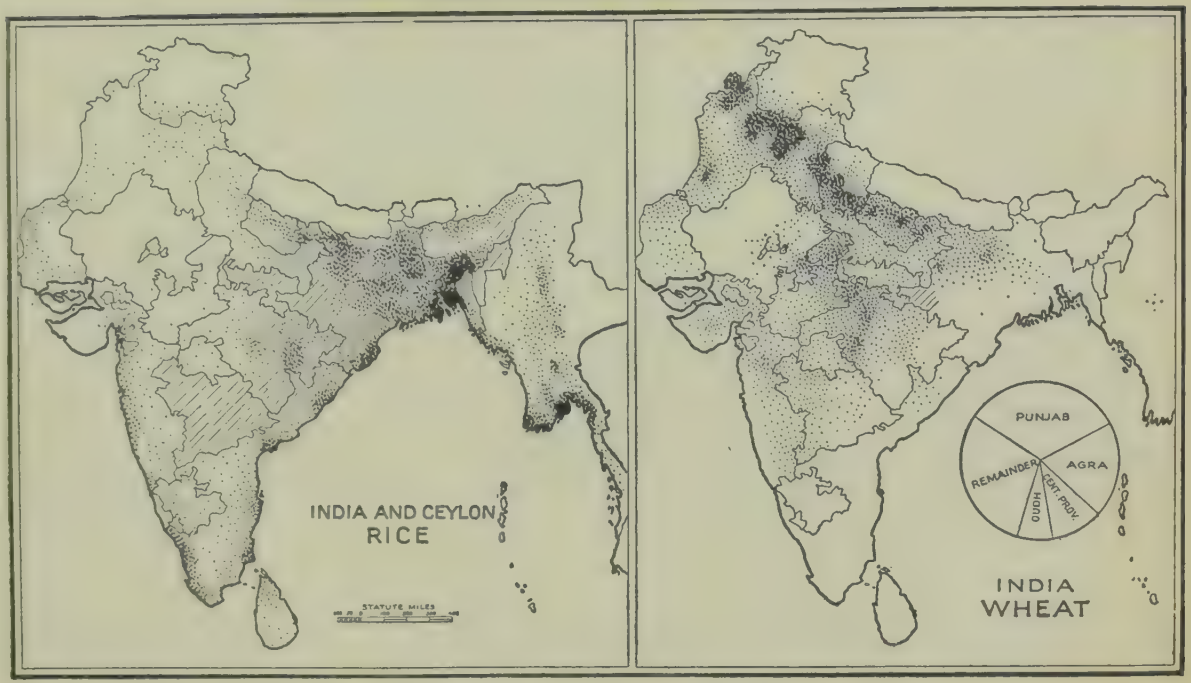


FIG. 212. DISTRIBUTION OF RICE AND WHEAT IN INDIA

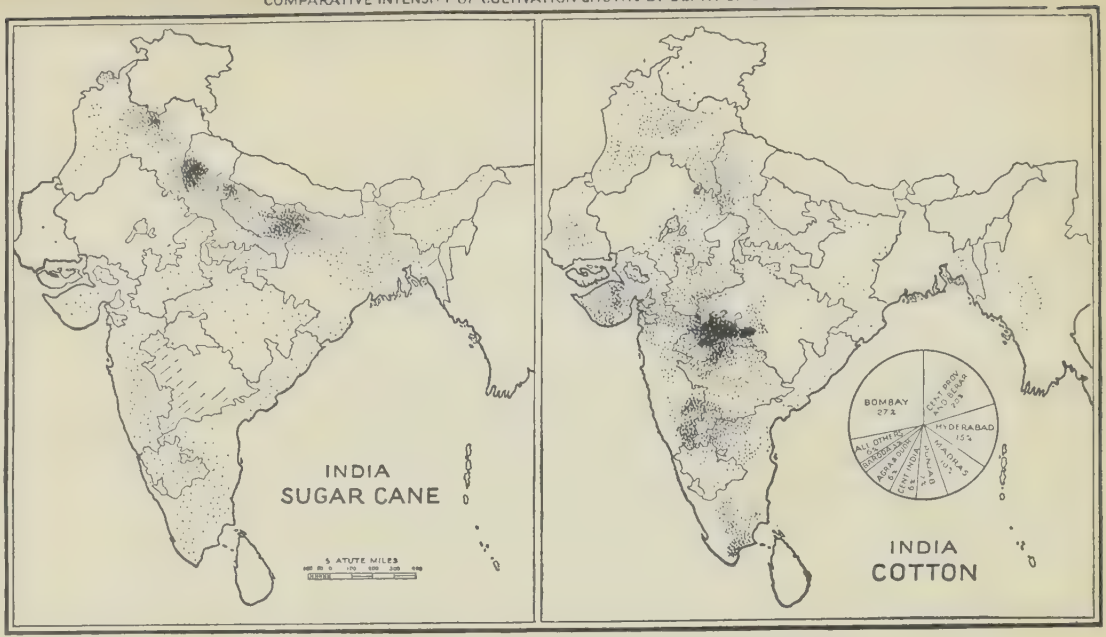


FIG. 213. DISTRIBUTION OF SUGAR CANE AND COTTON IN INDIA

well adapted to the growth of this plant (Fig. 213). The western slopes of the Western Ghats are covered with a dense forest, which contains valuable timber, the most important of which is teak. This wood is also cut in the dense forests of Upper Burma and floated down the *Irrawaddy River* to be shipped to Europe.

Tea is grown chiefly in Burma, Ceylon, and the south-western part of the peninsula.

Sec. 545. Minerals.—Coal is widely distributed in India, but on account of the warm climate, and the few factories, there is not a great local demand and not much is exported. Gold and petroleum are the other two important minerals. The gold is obtained in the southern peninsula and the petroleum in Burma.

Sec. 546. Manufacturing.—A very large part of the manufacturing of India is done in the home or in the small shop rather than in the large factory. In the Punjab and Kashmir in the north the spinning and weaving of cotton and woollen fabrics are widespread. Though a large portion of the fabrics woven are coarse, the shawls of Kashmir are noted for their beauty and fineness. Within recent years the manufacturing of cotton goods in factories built on the European plan has greatly developed in the city of *Bombay* on the west coast.

Sec. 547. Cities.—*Delhi*, the capital, which is about one-half the size of Toronto, is a beautiful city in the plain of the Ganges. *Calcutta*, the largest city in India and until recently the capital, is situated at the mouth of the Ganges. It is the central commercial city of one of the most densely populated districts of India. It also has numerous manufactures. *Bombay*, the second largest city, is the great seaport on the west coast and receives the cotton and other products of the Deccan for shipment to Europe. Its growth has been very rapid. *Madras* is the chief seaport on the eastern side of the peninsula. With the development of the railways it has lost a good deal of its trade to Bombay, which is more advantageously situated for European trade. *Karachi*, at the mouth of the Indus River, is connected by railway with the wheat and cotton fields of Northern India, and since it is of all ports in India the nearest to the Suez Canal it is certain to increase in importance.

Sec. 548. Transportation.—Formerly the rivers of India were the chief means of transportation, for in the northern plains there is no material with which to construct roads, and during the rainy season such roads as there are become impassable. But India is now well supplied with railways, and the recent rapid development of the country is largely a result of this improved means of transportation.

Malay Peninsula, Siam, and French Indo-China

Sec. 549.—Indo-China includes the Malay Peninsula, largely under British rule, Siam, an independent kingdom, and French Indo-China. All are well watered and the staple production is rice (Map 45 in Atlas). Tobacco, cotton, and sugar are also grown to a certain extent. The Malay Peninsula furnishes one-half of the world's supply of tin and more rubber than Brazil. This

FIG. 214. RELATIVE SIZES OF CHINA AND CANADA

Which is the larger? Which has the greater part of its area in warm temperate climates?

latter commodity, however, is not collected wild in the forest, as in Brazil, but is grown on plantations. *Singapore*, situated on an island at the south of Malay Peninsula, is one of the most important ports in the world. It receives a large part of the products of South-eastern Asia that are for export, and also is the distributing centre for the same region of manufactured goods from Europe. Situated midway between India and China it is the chief halting place for ships between the two countries. The majority of the inhabitants are Chinese.

China

Sec. 550.—The Chinese Republic, consisting of China Proper, together with *Manchuria* and *Mongolia* to the north, and *Tibet* and *Chinese Turkestan* to the east, is next to Russia the largest country in the world, occupying about one-fifth of the whole area of Asia. It is larger than Canada by two hundred thousand square miles. Its estimated population is about the same as that of India (Fig. 214).

Sec. 551. Surface.—With the exception of the Great Plain the surface of China is mountainous. From Tibet it drops down in a series of steps to the coast (Map 51 in Atlas). However, there are many wide, level valleys scattered throughout the country. The physical surroundings go far to account for the fact that China has been so exclusive and so little influenced by the other nations of the world. On the north, west, and south she was hemmed in by such impassable barriers as the Plateau of Tibet, the Deserts of Turkestan and Gobi, and the unknown forests of Siberia, and on the east by, what was until recently, the impassable sea.

Two great rivers, the *Hwang-ho* and *Yang-tsze-kiang*, rise in the Plateau of Tibet, follow an irregular course to the east, and empty into the Yellow Sea. The Hwang-ho on account of its rocky bottom and turbulent current in its upper course, the shallows of its lower course, and its swift current is of little value for navigation. The Yang-tsze-kiang on the other hand is navigable for large ocean steamers up to the great city of *Han-kau* and for smaller ones almost to the edge of the plateau of Tibet.

Sec. 552. Agriculture. The chief occupation of the Chinese is the cultivation of the land, which they do very skilfully. Every portion of arable land is brought under intensive cultivation, and two crops are grown throughout the valley of the Yang-tsze, while only one can be grown in the cooler regions of the north. Opium, wheat, beans, cotton, millet, and some rice are the chief crops of the north (Map 45 in Atlas). Tea, rice, opium, silk, cotton, and grass cloth are grown along the valley of the Yang-tsze.

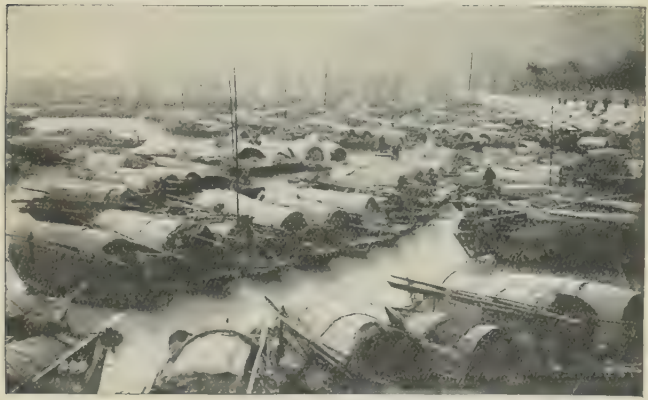
Sec. 553. Mining. China undoubtedly has the greatest supplies of easily accessible coal of any country in the world, and especially of the highest quality of coal, anthracite. It is true that up to the present it has been but little developed, but since railways have begun to penetrate the country, a great development may be looked for. Iron and tin are also found in large quantities and are mined to a small extent.

Sec. 554. Cities. *Peking*, the capital of the Republic, is situated in the north of China Proper. *Tien-tsin* is the great commercial city of the north, *Shang-hai*, near the mouth of the Yang-tsze-kiang,

[*Courtesy of J. L. McPherson, B.A., Secretary Y.M.C.A., Hong Kong.*

FIG. 215. A BETTER CLASS CHINESE STREET

The long baskets are used for carrying pigs. Are there any sidewalks? Is the street wide or narrow? Are the buildings much like those on a street in a Canadian city? Where do the people walk in the street?



[*Courtesy of J. L. McPherson, B.A., Secretary Y.M.C.A., Hong Kong.*

FIG. 216. CHINESE HOUSE BOATS

How would you and your family like to live in one of these? Forty thousand people in Hong Kong and two hundred thousand in Canton live in such houses. Why do you suppose they live in such houses?

is the receiving and distributing centre of the whole valley of that great river and also of North China. In population it is only exceeded by Han-kau on the same river, which is a great industrial centre and is bound to keep its predominant place among the cities of China. *Canton* is the great commercial centre of the south. The city of *Victoria* on the island of *Hong-Kong*, a British possession, is the commercial and financial centre of British commerce with China and Japan. It and Shang-hai are the great centres of the financial and industrial representatives of Europe and America.

Japan

Sec. 555. Extent and population.—The seven large, and over four thousand small islands, which form the greater part of the Empire of Japan, are the unsubmerged parts of a range of mountains lying off the coast of Eastern Asia (Map 44 in Atlas). The peninsula of Korea was annexed in 1910. Altogether the area of the Empire is more than three times as great as that of Great Britain (Fig. 217). Japan, which is one of the most densely settled countries, has a population almost twice as great as that of Great Britain and about equal to that of Germany.

FIG. 217. COMPARISON OF AREA OF JAPAN AND KOREA WITH THAT OF EASTERN CANADA

Sec. 556. Surface and climate. — The greater portion of the Japanese islands is occupied by mountains, which run throughout their length. The coastal plain in many parts is very constricted and is nowhere extensive, the greatest expansion being around Tokio (Map 44 in Atlas).

Surrounded by water, Japan does not experience the extremes of summer and winter to such an extent as China. The winter winds blowing out from Central Asia make the climate cold, especially on the western side of the mountains. The Pacific

[*Courtesy of Intelligence Branch, Department of Trade and Commerce, Ottawa.*

FIG. 218. A JAPANESE FAMILY AT A MEAL

What is the mother serving from the wooden pail? The child seems to like it. Note the neatness and cleanliness of everything about the house and persons, the fine heads of hair of the women, the small table and the tea-pot. What covers the floor? Is there much furniture in the room?

[*Courtesy of Intelligence Branch, Department of Trade and Commerce, Ottawa.*

FIG. 219. NURSE GIRLS WITH THEIR CHARGES PLAYING GAMES NEAR A JAPANESE TEMPLE

Why do the Japanese carry the children in this way instead of in baby-carriages? What kind of shoes have the girls?

Ocean along the east with its warm current makes that coast mild in winter. During this season the dry winds from the land cause little rainfall. In summer the monsoon, which blows in toward Central Asia, makes the whole country warm and humid and causes heavy rainfall in most parts (Maps 47, 48, and 49 in Atlas).

Sec. 557. Industries.—Since not more than one-fifth of the land is capable of cultivation, and since until recently Japan has been almost entirely an agricultural country, the seventy millions of people are compelled to cultivate the land intensively, and each family can have only a very small farm. The chief crop in the lowlands along the coast is rice. The crops of the uplands are barley, oats, wheat, beans, potatoes, and millet in the north, and tea and mulberry leaves in the south. Of course the mulberry leaves are used as food for the silkworm, and so great has been the development of the silk industry, that to-day Japan leads the world in the production of raw silk. There are very few cattle, sheep, and horses in the country, and beef, mutton, milk, cheese, and butter are not common articles of food. As a substitute for these they eat great quantities of fish, which are caught in large numbers off all their coasts. Indeed almost one million people are engaged entirely in fishing, and many farmers also carry on fishing as a secondary occupation.

Manufacturing of some kind is carried on in almost every household. The weaving of silk and cotton, the making of pottery, the weaving of lattice work, the plaiting of straw, and many other domestic industries engage the spare time of millions of Japanese men and women. On account of the abundance of cheap labour, articles manufactured in this crude fashion are able to compete with the factory-made articles of Europe and America. But a change is taking place in Japanese industry, and large manufacturing industries are rapidly being established in the cities, and already the domestic industry has begun to suffer.

In such a mountainous country as Japan mining should play a prominent part. Already she mines more copper than any other country in the world except the United States. The next most important mineral is coal. Petroleum, gold, antimony, and iron come next in order.

Sec. 558. Cities.—Japan can boast of having the two largest cities in Asia, *Tokio* and *Osaka*. The former city, which is the capital, is situated on the most extensive plain in Japan, and is at the centre of one of the most densely populated regions of the world. As the water in Tokio Bay is shallow, the largest steamers are unable to reach the city and load and unload at *Yokohama*, which is its seaport. Osaka is a great industrial centre at the south of the largest island.

CHAPTER XLVII

AFRICA

Project

Sec. 559. To find out why Africa is backward.—What fraction of Africa lies between the tropics? (Map 52 in Atlas.) Draw comparisons in this respect with the other continents. Are tropical countries usually suitable for European settlement? What part of Africa would you expect Europeans to reach first? What is the rainfall in that part of Africa that lies north of the tropic of Cancer? (Map 55 in Atlas.) What is the character of its vegetation? (Map 56 in Atlas.) From the answers given to the two preceding questions decide whether this part of Africa, which is nearest to Europe, would be attractive to Europeans. What is the altitude of the greater part of Africa between the Sahara and the Cape of Good Hope? (Map 52 in Atlas.) Do the highlands come near to the coast? Is the plain along the coast wide or narrow? What will be the nature of the rivers as they pass from the highlands to the coastal plain? In what part of the rivers will rapids occur? How did these rapids affect the exploration of the country? Before the Suez Canal was dug, which coast of Africa, the east or the west, was more accessible to Europeans? On which coast would Europeans be more likely to settle? Why would they not settle along the west coast on the border of the Sahara? (Map 56 in Atlas.) What is the amount of rainfall along the coast of the Gulf of Guinea? (Map 55 in Atlas.) What is the condition of the vegetation? (Map 56 in Atlas.) What is the temperature of this coast in July and January? (Maps 53 and 54 in Atlas.) After studying the answers to the last three questions, give as many reasons as possible why Europeans would not readily settle along this coast. What is the extent of the rainfall on the west coast of Africa between the mouth of the Congo River and the Cape of Good Hope? (Map 55 in Atlas.) What is the nature of its vegetation? (Map 56 in Atlas.) Is this part of the west coast suitable for European settlement? Study from Maps 53, 54, 55, and 56 in the Atlas the conditions of the different parts of the east coast as to temperature, rainfall, and vegetation, and give reasons why the different parts of it are suitable or unsuitable for European settlement. What part of the coast of Africa is most suitable for European settlement? Is

this part most progressive ? What difficulties are encountered in the construction of railways from the coast to the interior ? After considering the answers to the preceding question and to the questions on the rivers, give two reasons why the interior of Africa has not been rapidly explored or settled.

Sec. 560. Size and boundaries.—Among the continents Africa is surpassed in size only by Asia, which is almost one-third larger. It is a great peninsula stretching to the south of Europe and Western Asia. Like North and South America it is somewhat triangular in shape.

On the north Africa is bounded by the Mediterranean Sea, on the east by the Red Sea and the Indian Ocean, and on the west by the Atlantic Ocean, on the south it comes to a point, from which a line drawn directly south separates the Indian from the Atlantic Ocean.

Sec. 561. Divisions. — The political divisions of Africa differ from those of the other continents in this respect that, with three exceptions, *Liberia* on the west, and *Abyssinia* and *Egypt* in the east, they are not independent states but colonies of the different European countries. Bordering on the Mediterranean Sea are *Morocco*, *Algeria*, and *Tunis*, which are French colonies ; *Tripoli*, an Italian colony; and *Egypt*, which was recently given its independence by Great Britain, but which is still under her protection. On the east side are the *Anglo-Egyptian Sudan*, a colony of Britain ; *Abyssinia* ; *Somaliland*, divided between Britain and Italy ; *Kenya Colony* and *Uganda Protectorate*, both British possessions ; *Tanganyika Territory*, formerly belonging to Germany, now a colony of the United Kingdom ; *Portuguese East Africa* ; and *South Africa*, a name given to a group of British possessions, including the *Union of South Africa*, *Rhodesia*, and several other colonies of lesser importance. On the west side are *Angola*, a Portuguese colony ; *Belgian Congo*, one of the largest political divisions of Africa ; *French Equatorial Africa* ; and *Nigeria*, the most promising of the British crown colonies. West of Nigeria are a number of small colonies, mostly belonging to Britain and France. Lying south of the Mediterranean States is a vast region not very definitely marked off, which is probably the least known part of Africa. It is called the *French Sudan*.

Sec. 562. People. The natives of Africa may be divided into two great groups. Those inhabiting the countries on and near the Mediterranean Sea belong to the Hamitic and Semitic stocks. They are of considerable civilization and closely related to the peoples of the adjoining parts of Asia. The principal races are the Moors, Arabs, Copts and Egyptians, and the prevailing religion is the Mohammedan. South of the Sahara Desert the natives are

of the negro race. They are distinguished by their black skin, woolly hair, and thick lips, and except where they have come under the influence of Europeans, are pagan and of low civilization. The negroes are of many types, differing greatly both in size and colour.

The tropical parts of Africa have a climate unsuitable for Europeans. In South Africa, however, there are large numbers of British and Dutch. The latter came to this part of Africa over one hundred and fifty years ago, when it was a colony of the Dutch Republic, and the British migrated later when, during the Napoleonic wars, the South African settlements, known as the Cape of Good Hope, became a British colony.

Sec. 563. Coast.—Round the whole of Africa the coast-line is very compact, and the continental shelf very narrow (Map 52 in Atlas). With the exception of *Madagascar* on the eastern side, there is not a single important island near the coast. The *Canary* and *Madeira Islands* off the north-west coast are largely volcanic in origin. The only important coast waters are the *Red Sea* and *Gulf of Aden*, separating Africa from Asia. The *Cape of Good Hope*, near the south point of Africa, is the most famous cape in the world.

Sec. 564. Surface.—The interior part of Africa is occupied by an immense plateau, and the coastal plain is remarkably narrow. Almost the whole of Africa south of five degrees south latitude is more than three thousand feet high (Map 52 in Atlas). The rise in this region from the very narrow coastal plain to the elevated plateau takes place, not gradually, but in a series of steep escarpments, which look like mountains from a distance. The plateau is highest along the eastern and western borders, consequently it is somewhat saucer-shaped. Running north from the main plateau are three important highlands. The most easterly elevated portion passes as a broad plateau through Kenya Colony and Abyssinia, where it is very high, and is continued as a narrow band between the Red Sea and the River Nile. The most westerly follows the coast, swings around the Gulf of Guinea, and extends to the western limit of the continent. A central highland, which runs north into the Sahara, forms a watershed between the two great African rivers, the Nile and the Congo. Along the north coast of Africa run a number of parallel ranges, called the *Atlas Mountains*, which extend through Morocco, Algeria, and Tunis, and then dip under the Mediterranean Sea to reappear in Malta and Sicily. Between the Atlas Mountains and the Southern Plateau lies the great desert plain of the *Sahara*. It is hemmed in north, east and south by highlands. Hence, like the Southern Plateau, it forms a saucer-like hollow surrounded by highlands.

[*Courtesy of South African Railways.*

FIG. 220. EXTERIOR OF NATIVE HUT, NATAL

Describe the structure of the hut.

[*Courtesy of South African Railways.*

FIG. 221. INTERIOR OF NATIVE HUT, NATAL

Of what is the floor composed? Of what is the roof? What utensils are seen? What vegetable is abundant?

Sec. 565. Rivers and lakes.—Africa was for a long time rightly called the Dark Continent, because little was known about it. This was partly because the coastal plains were narrow and unhealthy, and also because the rivers in their lower courses were barred by the rapids and waterfalls created by their descent from the highlands so near the coast. Hence, with the exception of the Nile, the great rivers of Africa were practically unknown for centuries. *The Nile,* one of the most notable rivers in the world, rises in *Victoria Nyanza,* which is the largest lake in Africa, and next to Lake Superior the largest in the world. It receives tributaries from the well-watered highlands of Abyssinia, and then flows for hundreds of miles without receiving a single affluent. It finally empties into the Mediterranean Sea in a number of channels, which form a great delta. The Nile is navigable in its upper and lower courses, but navigation is interrupted by six cataracts along its middle course as it descends from the plateau.

Although the *Congo* is one of the greatest rivers of the world, it has been only recently explored. It has many large tributaries, and although a series of rapids obstruct its lower reaches, its upper course and many of its affluents are navigable. Rising not far from the source of the Nile, this mighty river drains *Tanganyika,* the second largest lake in Africa.

The only great river emptying into the Indian Ocean is the *Zambezi,* which drains a large part of the southern plateau. The celebrated *Victoria Falls,* surpassing the cataract at Niagara in width and height, occurs where this river passes from the central plateau to the eastern coastal plain (Fig. 222).

The *Niger River* rises near the Atlantic Ocean in a region of heavy rains, flows east on the edge of the Sahara Desert, turns south, crosses the highlands, and finally empties into the Gulf of Guinea (Map 52 in Atlas). Though it is navigable throughout the greater part of its length, there are rapids in its lower course.

Sec. 566. Climate.—Four-fifths of African territory lies within the tropics, and the extra-tropical portions are so near to the torrid zone that no part of Africa except some of the very highest regions is very cold. During the northern summer the vertical sun makes the Sahara one of the hottest regions in the world (Map 54 in Atlas). Equatorial Africa is hot and humid at this season, but South Africa is comparatively cool and in the higher altitudes of the interior even cold. During the northern winter the vertical sun shines over South Africa, and the interior plateau becomes as hot as the Sahara was six months before. But towards the north of the continent the temperature gradually decreases and along the Mediterranean the weather is pleasant (Map 53 in Atlas).

As the greater part of the African Highlands is close to the

coast (Map 52 in Atlas), the winds from the oceans are unable to bring much moisture into the interior. Consequently the interior of both the north and the south of the continent is desert (Map 55 in Atlas); the barren region in the north is called the *Sahara Desert*, and the region in the south the *Kalahari Desert*. The greater part of the northern half of Africa receives little or no rain throughout the year (Map 55 in Atlas). In winter the region north of the Atlas Mountains comes within the influence of the westerlies, and the north-west winds from the Mediterranean Sea and the Atlantic Ocean, which blow up these mountains, cause heavy rains and even some snow in the higher peaks. During the summer the south-west winds from the Gulf of Guinea are drawn in on the land by the low pressure over the hot interior and produce an abundant summer rainfall over the whole Equatorial region from the Guinea Coast to the Abyssinian Highlands (Map 4 in Atlas). In the winter a large part of this region is almost rainless.

During the South African summer (December to February) the low pressure of the heated interior draws in the moist winds from the Indian Ocean, which, as they reach the highlands, cause heavy rains to fall. Towards the west coast, the rainfall diminishes. During the winter (June to August) no part of South Africa receives much rain, except the south-west, which comes under the influence of the westerlies.

Both North and South Africa, having dry climates, are extremely healthy, but between the tropics the lower coastal plains, where a hot, humid, rainy period occurs twice a year, are generally unsuitable for Europeans. But some of the higher and drier portions of this region, such as parts of Kenya Colony, are reasonably healthy.

Sec. 567. Vegetation.—Map 56 in Atlas shows the distribution of the different kinds of vegetation. If this map is compared with Map 55 in the Atlas, which shows the rainfall, the close relationship between the two will be immediately evident. The Equatorial region of heavy rainfall is covered with dense tropical forest. On each border of this region, where the rainfall is lighter, the forest is gradually replaced by grass, and still further to the north and south the grass land is replaced by dry steppe or desert.

Sec. 568. Animals.—Africa is the land of big game. The rhinoceros, giraffe, zebra, lion, and leopard frequent the open grass lands, and the elephant is found in both the tropical forest and the grass land. The single-humped camel is used as a domestic animal in the northern deserts. The rivers of the intertropical belt abound in hippopotami and crocodiles. Among birds the ostrich is the most striking (Fig. 226). It is widely scattered

[*Courtesy of South African Railways.*

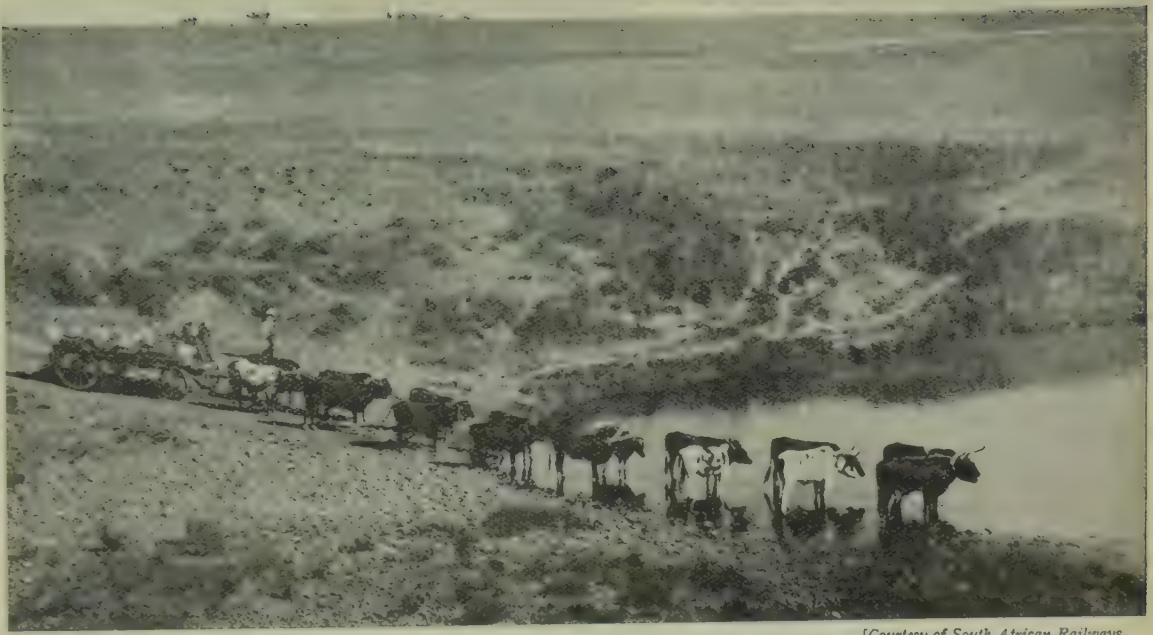
FIG. 222. VICTORIA FALLS, RHODESIA

Find the position of this fall on Map 52 in Atlas. What river is it on? It is the only rival to the Falls of Niagara.

[*Courtesy of J. H. Hornung.*

FIG. 223. THE DATE-PALM IN EGYPT

What are the triangular objects behind the trees? How high are the trees? Where is the fruit? The marks on the tree trunks are the scars left by falling leaves. Describe the costumes of the people. Is there any grass or other vegetation near where the date-palms are growing? Does there appear to be any vegetation in the distant parts? Explain why there is such a contrast of vegetation in the foreground and background.



[*Courtesy of South African Railways.*

FIG. 224. OX WAGON TRANSPORT IN NATAL

What is the character of the vegetation? What would you infer about the climate from the picture? Which would find food in such a country more readily, an ox or a horse? Why do they use oxen instead of horses? Is the country cultivated? What is the nature of its surface? Does it appear to have roads? Why do they use so many oxen? Find a sleeping-cot. Which is the woman?

north and south over the deserts and dry steppes. Some of the insects, such as the mosquito and the tsetse fly, have remarkable influence upon the life of the continent. Many thousands of square miles of Africa are rendered uninhabitable to Europeans by mosquitoes, whose bites cause malaria. The bite of the tsetse fly is fatal to domestic animals, and causes one of the most dreaded human diseases, sleeping sickness. In many parts of Africa cattle cannot be reared on account of the presence of this fly.

Sec. 569. Productions of Mediterranean States.—In the Mediterranean States of Africa, the rains occur in winter, and irrigation is necessary for the production of summer crops. In the warm lowlands, olives, oranges, lemons, and grapes are the chief products (Fig. 200). In the higher, cooler parts of the Atlas region, wheat and barley are grown, sheep, cattle, and goats are reared, and cork is obtained from the cork oak, which grows in the forests. Beyond the mountains on the border of the desert gum-arabic is obtained from acacia-trees, and dates from the date-palm (Fig. 223) which grows in the desert oases (Map 57 in Atlas).

Sec. 570. Egypt.—The whole of Egypt is an eastern continuation of the Sahara desert, and only narrow strips on both sides of the Nile are cultivated. The *Blue Nile* rises in the Abyssinian Highlands where, as we have seen, there are very heavy summer rains (Sec. 566). These cause the river to rise and to overflow its banks. In June the effect of these floods is felt in Egypt. The rise continues until September, when the water is at its greatest height, and in October the water begins to fall. Crops could formerly be raised only during the autumn and winter, while the land still retained the moisture absorbed during the flood. But during the late spring and summer there was no water for irrigation, and no crops could be raised. But British engineering skill and enterprise have changed all this. Near *Assuan* a dam over six thousand feet long has been built right across the river. As the Nile flood is subsiding during the autumn, the gates of the dam are closed and the water is stored above the dam in a great lake over two hundred miles long. In the spring, when the water in the Nile below the dam is becoming so low that it cannot be used for irrigation, the gates of the dam are opened gradually, and the water in the Nile below is kept high enough to be run upon the land to water it. Consequently, summer crops can now be grown throughout this area.

During the hot summer, cotton, sugar-cane, and rice are grown; in autumn a second crop of rice, corn, and vegetables; and in winter wheat, barley, and beans.

Cairo, one of the most notable cities of the world, is situated on the delta of the Nile. It has a greater population than Montreal,

and is the largest city in Africa. It is on the caravan routes from east to west, and on the only water-way from the north into the interior of Africa. Gum, ivory, and ostrich feathers from the Sudan, cotton and sugar from Upper Egypt, indigo and shawls from India, tobacco from Asiatic Turkey, and manufactures from Europe all pass through Cairo. Its population comprises a great variety of races. *Alexandria*, at the mouth of the Nile, has been a great shipping port for two thousand years.

Sec. 571. Productions of the Sahara and Equatorial Africa.—Throughout the greater part of this region there is little agriculture owing to the unhealthiness of the climate, the lack of labour, and the rank growth of weeds during the hot rainy season. In the Sahara, where cultivation is impossible because of lack of rain, dates are obtained in the many oases scattered over its surface. Gum-arabic is the sap of acacia-trees, which encircle the whole desert just where absolute barrenness is giving place to a semi-arid region, the vegetation of which is made possible by occasional rains (Map 57 in Atlas).

Throughout the Equatorial region on both the east and west sides cattle, sheep, and goats graze in the drier and higher lands, while wheat, barley, and corn are grown on the fertile highlands.

In the well watered lowlands on the east side of the continent coffee, cacao, rice, sugar-cane, and cotton are the chief cultivated crops. On the west coast the same products with the addition of pea-nuts, or ground nuts, are raised. In *St. Thomas Island* in the Gulf of Guinea the amount of cacao produced has increased so rapidly within recent years that its output competes with that of Ecuador and Brazil for the first position in the world.

Many marketable commodities are obtained also from the forests. Rubber is collected throughout the central and western parts of Equatorial Africa, and in especially large quantities from the Belgian Congo (Map 57 in Atlas). Palm-oil, a buttery substance, is obtained from the oil-palm, which grows in the same forests as the rubber trees. The oil is shipped to Europe and used for the making of soap and candles and for oiling machinery. Elephants are hunted throughout the region for their tusks, which make the most valuable ivory of commerce. Tin is mined in Nigeria, and one of the richest copper deposits in the world is found in the highlands of south-east Belgian Congo.

Since there are few Europeans throughout this region, and the amount of cultivation and commerce is small, there are no large cities.

Sec. 572. South Africa.—The term South Africa is usually applied to a group of British States including the Union of South Africa, Southern and Northern Rhodesia, and several protectorates of

[*Courtesy of South African Railways.*

FIG. 225. TABLE MOUNTAIN AND PIER OF CAPE TOWN, SOUTH AFRICA

Of what kind of rock is Table Mountain composed?

[*Courtesy of High Commissioner for South Africa.*

FIG. 226. AN OSTRICH FARM IN SOUTH AFRICA

The rearing of ostriches for their feathers is an important industry in South Africa.

lesser importance.] The Union of South Africa, which is by far the most important of these divisions, was originally a federation of four provinces, the Cape of Good Hope, Natal, Transvaal, and the Orange Free State. After the Great War the district along the west coast north of the province of the Cape of Good Hope, which had belonged to Germany, was added to the Union. Before the establishment of the Union the province of the Cape of Good Hope was called Cape Colony.

The rainfall, which is over twenty-five inches in the east, decreases almost to zero in the west (Map 55 in Atlas). Consequently, the greater density of population is found on the eastern side of the country. On account of the lack of moisture in many districts the chief occupation is ranching rather than farming, and immense numbers of sheep and smaller numbers of cattle and goats are raised. In the drier parts of the south of the Cape of Good Hope ostrich farming has become an important industry (Fig. 226), and in some of the lower, more humid districts near the coast in the same province as well as in Natal, fruits such as grapes, oranges, and pineapples are grown. In a few of the cooler, well-watered localities, such as the south-west part of the Cape of Good Hope, a considerable amount of wheat is grown.

The wealth of South Africa depends, above all, on its mining operations. Almost half of the world's output of gold, and practically the whole of its supply of diamonds come from these states. The chief gold mines are in the Transvaal along a ridge, called the *Witwatersrand*, or more usually the *Rand*. The city of *Johannesburg*, which is the centre of the mining industry in this district, is the most populous in South Africa. Gold in lesser quantities is mined in other parts of the Transvaal, and in Southern Rhodesia. The diamond mines are situated in and near *Kimberley* in the Cape of Good Hope.

Cape Town, situated in the south-west corner of the Cape of Good Hope Province, is one of the oldest towns in South Africa and the centre of English life in the Union. Owing to the fact that the westerlies blow over this corner of Africa during the winter (June to August) there is a good rainfall, and wheat, grapes, and oranges are grown. Cape Town is a terminus of the railways which run north into the interior and is an important collecting and distributing centre. The Parliament of the Union of South Africa meets in Cape Town, but the Government offices are at *Pretoria* in the Transvaal.

Sec. 573. Communications.—There are few good roads in Africa. In the forests of Equatorial Africa narrow, trodden paths are the only means of transportation by land, and all freight is carried on the backs of natives. In the Sahara goods are transported on the

FIG. 227. AFRICA, SHOWING CAPE TO CAIRO RAILWAY

The part completed is barred black and white alternately. All other railways are shown by double lines with transverse bars. British possessions are white, other parts black and white.

backs of camels, which are driven across the desert in large companies called *caravans*. The commodities from the region south of the Sahara are collected at *Timbuktu*, on the Niger River. From this point the caravans strike across the desert to Morocco, Algeria, and Tunis.

Railways are confined to the districts directly under the control of Europeans, and are most numerous in South Africa. As most of the railways connect the interior localities with the ocean ports, and as the highlands come close to the coast the gradients on the railways are very steep, and heavy loads are impossible. Most of the railways of Africa are of much narrower gauge than those in Canada, and, accordingly, the locomotives and cars are smaller.

Sec. 574. The Cape to Cairo Railway.—Sir Cecil Rhodes, one of the greatest statesmen of South Africa, advocated the building of a railway from Cape Town to Cairo, and he also desired that it should run entirely in British territory. Owing to the British conquest of German East Africa (now Tanganyika Territory) during the Great War, a continuous zone of British territory now extends between the two cities. Beginning at the south this zone consists of the Cape of Good Hope, Bechuanaland Protectorate, Rhodesia, Tanganyika, Uganda, Anglo-Egyptian Sudan, and Egypt. Already a great part of this railway has been constructed. Beginning at Cape Town it passes through *Kimberley*, *Mafeking*, *Bulawayo*, *Livingstone* (near the famous Victoria Falls), *Broken Hill*, and to *Katanga*. The northern end of the railway begins at *Alexandria*, passes through Cairo and runs to *Assuan*. Then there is a slight gap, after which it is continued beyond *Khartum* (Fig. 227).

Sec. 575. Suez Canal.—Africa is connected with Asia by the narrow Isthmus of Suez, which for centuries forced European vessels to circumnavigate Africa in order to reach India. In 1864 the Suez Canal across the Isthmus was completed. It is one hundred miles long, over twenty-eight feet deep, and wide enough to permit ships to pass each other. Since the surface of the Mediterranean and Red Seas are at the same level the canal requires no locks. When one considers that most of the commerce between Europe on the one hand and South Asia, East Africa, and Australia on the other, passes through this canal, one can readily understand its importance. *Port Said* is situated at the northern end of the canal, and *Suez* at the southern end.

CHAPTER XLVIII

AUSTRALASIA

Commonwealth of Australia

Sec. 576.—The term *Australasia* is here used to include the islands of Australia, Tasmania, and New Zealand.

Sec. 577. Position, size, and boundaries.—One of the greatest hindrances to the development of the continent of Australia is its unfavourable position, for it is an island in the southern hemisphere, hundreds of miles from Asia, the nearest continent, four thousand miles from Africa, and eight to ten thousand miles from Europe or North America.

Australia is the largest island in the world, being about the same size as the United States without Alaska, and three-fourths as large as Canada.

On the north it is separated from the East Indies by the *Timor Sea*, *Arafura Sea*, and *Torres Strait*. On the west and south it is bounded by the Indian Ocean, though that part of the Indian Ocean to the south of Australia is often called the *Southern Ocean*. On the east lies the Pacific Ocean.

Sec. 578. People and divisions.—When Australia was discovered by Europeans it was inhabited by people of a very low type (Fig. 228). Even at that time the natives were not numerous, and they have steadily decreased in numbers, until at the present time there are probably not more than one hundred thousand on the whole continent. Those living near the most thickly settled districts are at least partially civilized, but there are large numbers in the north and west who have scarcely come in contact with the European settlers and are still savage.

On account of its great distance from Europe, and the failure of the state government until about thirty years ago to encourage immigration, its development was slow, and even yet not many Europeans other than natives of the United Kingdom have immigrated to this continent. Consequently, almost ninety-seven per cent. of the total population is of British or Australian birth. Australia's comparative nearness to the East Indies, China, Japan, and India has led many Asiatics to immigrate into the northern parts of the continent. The Australians have become alarmed at this movement and have passed laws rigidly excluding all

[*Courtesy of Queensland Government.*

FIG. 228. NATIVES OF QUEENSLAND CLIMBING A TREE

What does he use the hatchet for?

Asiatics, as the citizens are determined to keep Australia for the white man.

Sec. 579. Divisions.—Before the year 1900 Australia was divided into six separate colonies, each of which had its own government. But on 1st January, 1901, they were combined to form the Commonwealth of Australia, of which each division became a state. On the eastern side of the continent are three states, which are named, in order from north to south, *Queensland*, *New South Wales*, and *Victoria*. On the western side is the largest of the states, *Western Australia*, and on the south is *South Australia*. The *Island of Tasmania* forms the sixth and smallest state. North of South Australia is a little-known region, containing few inhabitants, which is called the *Northern Territory*, and which is under the control of the Commonwealth Government. Recently a district called the *Federal Capital Territory* has been handed over by New South Wales to the Commonwealth Government to be used for a capital. In this territory the town of *Canberra* has been selected as the federal capital, but the government buildings are only now in the course of construction. In fact, the total population of the whole territory is only a few thousands. In the meantime the temporary seat of government is *Melbourne*, the capital of Victoria, and in population the second city of Australia.

During the Great War, *Kaiser Wilhelm's Land* in *New Guinea*, the *Bismarck Archipelago*, and the *Solomon Islands* to the east of New Guinea were taken from Germany by the Australians, and after the war they were placed under the administration of the Commonwealth Government. Australia also controls the government of *Norfolk Island*, situated in the Pacific Ocean eight hundred miles east of the continent.

Sec. 580. Coast.—As the coast-line of Australia is very compact, good harbours are few. The most irregular part of the coast-line is in the north, where the *Gulf of Carpentaria* cuts deeply into the coast. The fact that the islands adjoining Australia are intimately related geologically to this continent is indicated by the shallowness of the intervening channels (Map 60 in Atlas). The ocean between Tasmania and the mainland is less than six hundred feet deep, and a broad stretch of very shallow water separates New Guinea from the northern coast of the continent.

Along the north-east coast stretches the *Great Barrier Reef* (Map 60 in Atlas), which has been built by coral animals. It extends for twelve hundred miles at a distance of from ten to fifty miles from the coast, and at low tide reaches to about the surface of the water. No matter how turbulent the sea outside, the channel between the reef and the coast is calm, a great advantage to the coasting trade. There are several breaks in the reef, usually opposite the

[*Courtesy of Western Australian Government,*

FIG. 229. A LOG FROM A WESTERN AUSTRALIAN JARRAH TREE

What is the diameter of this tree? The jarrah tree sometimes grows 250 feet high. Its wood is hard, red, very durable, and is the chief timber used in the state.

mouths of rivers, but it requires a skilful sailor to wind his way through these intricate passages.

Sec. 581. Surface.—Australia is the least elevated of all the continents, only a very small fraction of the whole surface being more than fifteen hundred feet high (Map 60 in Atlas). A plateau, called the *Dividing Range* runs parallel to the east coast, and the plain between this highland and the coast is very narrow. West of the Dividing Range is the *Great Australian Plain*, which contains the chief rivers of the continent. This plain extends west to about the 135th meridian, and beyond that there is a low plateau, which occupies the western half of the continent.

Sec. 582. Drainage.—Since the highlands both east and west are close to the coast, the rivers flowing into the Indian and Pacific Oceans are small. In the north, where there is a heavy summer rainfall, there are numerous rivers, which during the dry winter become very low. The most important rivers are to be found in the Great Australian Plain. The chief of these is the *Murray*, which forms the boundary between Victoria and New South Wales, and its tributary, the *Darling*, which drains a large part of New South Wales east of the Dividing Range. During the rainy season both of these rivers are navigable throughout the greater part of their length, but during the dry winter season (June to August) the water is very low, and the Darling is often merely a string of small pools.

Sec. 583. Artesian basins.—If a boring is made in many parts of the dry interior of Australia, an artesian flow of water is generally obtained. Thousands of these flowing wells supply water for the flocks of sheep, and herds of cattle, and as these wells are bored farther and farther inland, more of the arid interior is being utilized for sheep ranching. The water is suited for stock, but not for irrigation. Its dissolved salts in time make the soil so alkaline that crops do not flourish.

Sec. 584. Climate. The climate of Australia is a serious hindrance to its development. The northern portion is in the torrid zone, and the most southern part of the mainland is not so far from the Equator as the southern parts of Ontario and Quebec. Moreover, a large part of the interior is bordered by highlands on both the east and the west. Hence the climate as a whole is hot, and during the summer (December to February) a considerable part of the interior forms one of the hottest regions in the world (Map 62 in Atlas). During the winter, even in the south, there is little frost, and snow is uncommon except in the higher peaks of the Dividing Range. The climate of the north is unpleasant on account of the high temperatures and great humidity. In the south the climate is much pleasanter, and the difference in temperature between

[*Courtesy of Queensland Government.*

FIG. 230. BOTTLE TREE, QUEENSLAND, AUSTRALIA

The natives make nets from its fibres and drink the sap found in reservoirs within the trunk. What is the height of this tree? What is the diameter of its trunk? Are the other trees seen in the picture of the same kind?

summer and winter is much greater, though, on account of the influence of the ocean, the extremes are much less than in Central and Eastern Canada.

The rainfall is largely dependent on the winds. In the northern part monsoons (Sec. 42) blow from the Equator toward Australia during the summer (December to February), and in the opposite direction during the winter (Maps 3 and 4 in Atlas). The moist summer monsoon causes heavy rainfall along the north and north-east coasts, and as there is little or no rain during the winter, the two divisions of the year may be more accurately described as the rainy and the dry season, rather than summer and winter.

In the interior there is little rainfall at any season of the year; this is especially true in the western plateau, which is one of the driest deserts in the world.

The southern part of West Australia, and the most southerly projecting parts of South Australia, Victoria, and Western Tasmania, come under the influence of the westerlies during the winter (June to August), and these regions receive a moderate rainfall during this season (Map 3 and 4 in Atlas).

Along the eastern coast the south-east trade-wind blows with a fair degree of steadiness, and there is a moderate rainfall well distributed throughout the year.

Sec. 585. Vegetation.—Along the northern and north-eastern coasts, where the rainfall is heavy, there is a dense jungle-like growth closely resembling the vegetation of the tropical islands adjoining Australia. Beyond the mountain ranges in the interior the vegetation is more typically Australian (Map 65 in Atlas). Where the rainfall in the interior is sufficient, there are forests composed of sombre *eucalyptus*, or gum-trees, and *acacias*. Some of the gum-trees are very tall. In fact, one species reaches 480 feet, thus surpassing even the giant sequoias of California. The timber of the gum-tree is of great value, as well as the gum and oil extracted from the leaves (Fig. 228). Farther within the interior of the country, the eucalyptus and acacias become smaller, and in what is called the *Australian bush* this stunted growth is very sparse. In the arid parts the bush gives place to the *scrub*, which is composed of acacias so tangled and covered with thorns that it is almost impenetrable. In the desert the scrub gives place to the *salt-bush*, a shrubby plant that forms one of the best grazing foods for sheep. Over thousands of square miles of the western plateau grows the hated *spinifex*, a coarse grass, which grows in tussocks often ten feet in diameter, and whose spines are a constant irritation to the traveller.

Sec. 586. Animals. Many of the mammals now living in Australia resemble more closely those which lived many ages ago

[*Courtesy of Australian Government.*

FIG. 231. A FLOCK OF SHEEP, NEW SOUTH WALES

Australia's most valuable animal.

in other parts of the world than those living at the present time in any other continent. The mammals are of a very low type of development, and most of them possess a pouch in which the young are carried for some time after they are born. The *kangaroos* are the largest and best known of these mammals. Two very remarkable species are the *duck-bill* and the *spiny ant-eater*, which differ from all other mammals in laying eggs. Altogether the mammals of Australia are of little economic value; indeed, they do much more harm than good.

Rabbits have been introduced into Australia from Europe and have multiplied so rapidly that they have become a great nuisance. Great wire fences are built to exclude them from unoccupied regions. One of the longest of these fences extends for eleven hundred miles between Queensland and New South Wales.

[Courtesy of Western Australian Government.

FIG. 232. WHEAT AWAITING EXPORT FROM WESTERN AUSTRALIA

How does the Australian method of storing wheat differ from that of the Prairie Provinces? Explain the climatic difference which allows this.

INDUSTRIES

Sec. 587. Ranching.—The chief industry of Australia is the ranching of cattle and sheep (Fig. 233). The dryness of the climate of the whole region west of the Dividing Range makes the tilling of the land impossible, except along some of the rivers of the south, where irrigation is employed. In all this region are great flocks of sheep, and so sparse is the vegetation that in many parts not more than one sheep can be reared to every four, five, or even ten acres. But the dry climate and desert grasses produce a sheep with a very superior fleece. The pastoralists, as they are called, often own

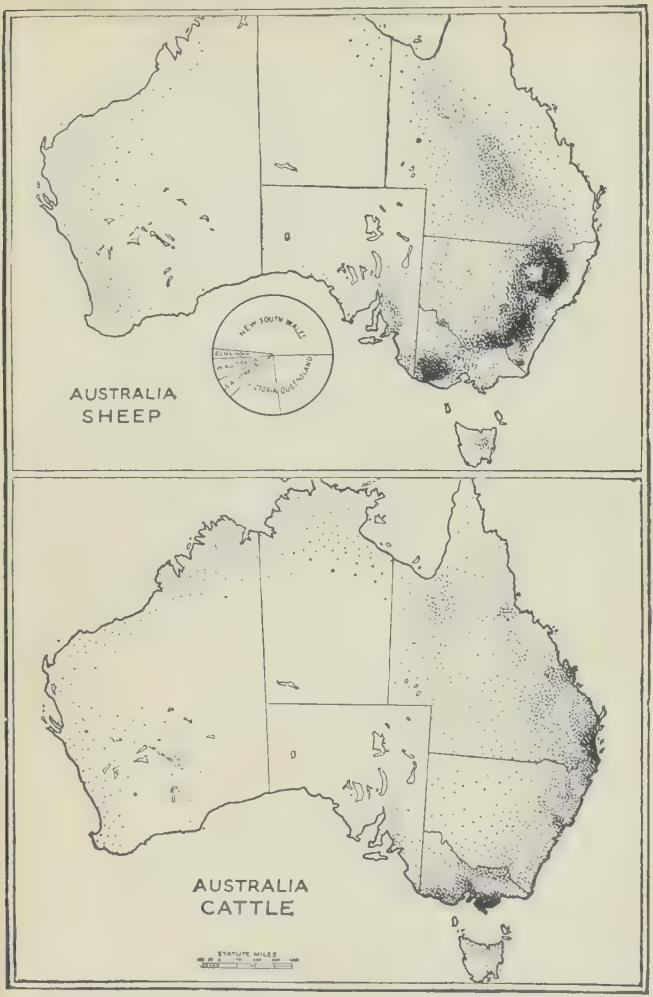


FIG. 233. DISTRIBUTION OF SHEEP AND CATTLE IN AUSTRALIA

Which are raised nearer the coast, cattle or sheep? Which region has the heavier rainfall? (Map 64 in Atlas.) Why are there no farm products in the interior?

many thousands of these sheep. The artesian wells of Queensland, New South Wales, and South Australia have enabled the pastoralists to lead their sheep farther and farther into the desert. At shearing time the sheep are driven to sheds, where the fleece is clipped by machinery. Then the wool is packed in bales and shipped chiefly to England. Twenty years ago it was almost impossible to dispose of the mutton, but since the employment of cold storage on ships, Australian mutton has been exported in larger and larger quantities to Britain, and it is quite possible that the value of the mutton may soon rival that of Australian wool. New South Wales produces almost one-half of the sheep, and Queensland comes next. Fig. 233 shows the distribution of the pastoral industry.

Since cattle-rearing requires a greater rainfall than the rearing of sheep, the chief sheep-raising district is to the west of the Dividing Range, and the chief cattle-raising district is to the east of this range (Map 61 in Atlas). In the more populous parts of New South Wales and Victoria the raising of dairy cattle has to a certain extent replaced the raising of cattle for beef. The dairying industry has been greatly stimulated by the equipment of ships with cold storage, and now Australia has become a large shipper of butter to the British market. Queensland possesses almost one-half of the cattle of the country.

The severe droughts that occur from time to time in Australia have caused great fluctuations in the number of sheep and cattle in the country.

Sec. 588. Agriculture.—The agricultural products of Australia are very varied. Sugar-cane and many tropical fruits are extensively grown on the east coast of Queensland (Map 61 in Atlas). Farther south, corn is raised, and in the southern part of the coast wheat is the main crop (Fig. 232).

Sec. 589. Mining.—The discovery of gold in Australia in 1851 gave the first impetus to immigration to that continent, and since that date gold has been the chief mineral product. But the mining has undergone many changes. The State of Victoria was the chief producer for a long time, but for the last twenty years has been outstripped by Western Australia, which now mines more gold per year than the Province of Ontario. Gold is mined in all the Australian states, but the amount obtained in each is steadily decreasing; nevertheless, Australia still stands third among gold-producing countries, only South Africa and the United States surpassing her. Copper, coal, silver, and lead are very generally distributed, and are mined in almost all the states. Tin is mined extensively in Tasmania and New South Wales.

Sec. 590. Fisheries.—The only important marine industry of

[*Courtesy of Tasmanian Government.*

FIG. 234. SANDY BAY, A PART OF HOBART, THE CAPITAL OF TASMANIA

Hobart has a very beautiful situation, with the mountains sloping back from it. It is the only city in Australia with a Canadian climate.

Australia is the dredging for pearl shells and pearls. This is carried on along the northern and western coast (Map 61 in Atlas). Divers, who are chiefly Asiatics, go down in the water to a depth of thirty to sixty feet and collect the shells and pearl oysters from the bottom. Fishing for the edible oyster is developing, and as a result of artificial cultivation is likely to become more extensive.

Sec. 591. Lumbering.—Among the various species of eucalyptus and acacias are numerous large trees, which furnish very hard timber of excellent quality for shipbuilding, cabinet-work, and the building of wharves and other structures partially or wholly under the water. From the leaves of the eucalyptus a valuable oil is obtained, and from its bark, as well as from that of the acacias, tannin is got, which is used in the tanning of hides.

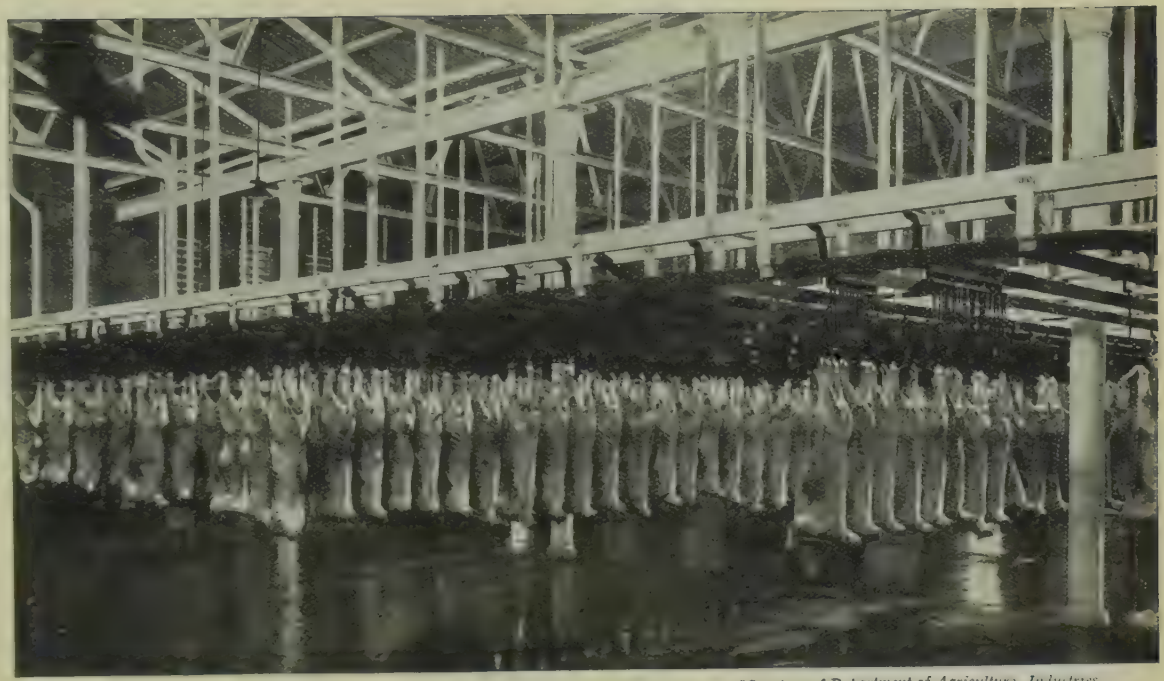
Cities

Sec. 592.—The population of Australia is largely confined to the east and south-east coast, and it is in this region that the chief cities are found. *Sydney*, the capital of New South Wales, the wealthiest and most populous state, has a population of three-quarters of a million, and is consequently larger than any Canadian city. Few cities in the world have such a deep, beautiful, commodious harbour. It is a converging point for the railways from the hinterland, north, south, and west, and from it are exported vast quantities of wool, mutton, beef, hides, corn, and coal. Standing at the centre of the chief coal-bearing basin of Australia, it has also become a great manufacturing centre. *Melbourne*, the capital of Victoria, and the temporary seat of the Commonwealth Government, is almost as large as Sydney. As a shipping centre it is more important than its rival, and it has numerous and varied manufactures. *Adelaide*, the capital of South Australia, *Brisbane*, the capital of Queensland, and *Perth*, the capital of West Australia, are all large, thriving cities situated on or near the coast. *Hobart*, the capital of Tasmania, is a beautiful, progressive seaport (Fig. 234).

Sec. 593. Transportation.—The rivers of Australia that are situated in the most thickly populated parts are short and not of great value for navigation, and the Murray and its tributary, the Darling, flow through a pastoral country where the commerce is not great. However, as these latter rivers are both navigable for many hundreds of miles, they form the chief means of transportation for a large portion of the southern part of the Great Australian Plain. Unfortunately the Murray, like the other rivers of the south, has sand-bars near the mouth, and goods brought down the

[*Courtesy of Department of Agriculture, Industries, and Commerce, New Zealand.*

FIG. 235. TYPICAL SETTLERS' HOMES IN THE BUSH COUNTRY OF NEW ZEALAND



[Courtesy of Department of Agriculture, Industries, and Commerce, New Zealand.

FIG. 236. NEW ZEALAND MUTTON IN COLD STORAGE

river have to be transferred by railway before they can be loaded on to ocean steamers.

The railways of Australia, which are largely owned by the government, are very extensive in the more populous parts along the east coast. As the greatest number of the lines pass from the narrow coastal plain into the elevated hinterland, the gradients are steep, and the expense of construction great. Victoria and New South Wales are particularly well supplied with railways. A *trans-Australian railway*, which connects Melbourne with Perth, was completed in 1917. Another trans-Australian railway from north to south is now under consideration. One great drawback to quick railway communication in Australia is the fact that the gauge varies; consequently engines and cars cannot be transferred from one line to another.

Dominion of New Zealand

Sec. 594.—The Dominion of New Zealand is about as large as the British Isles, and has about one-quarter of the area of Ontario. It is composed of two large islands, called the *North Island* and *South Island*, and a number of smaller ones. In 1901 New Zealand received control of a number of British Islands in the Pacific which were within its sphere of influence.

New Zealand is about twelve hundred miles east of Australia. North Island does not extend as far north as Sydney, and South Island extends farther south than Tasmania.

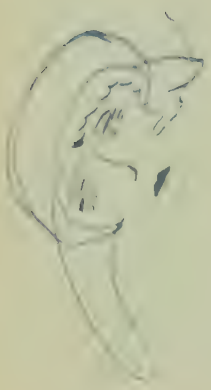
Sec. 595. Surface.—A high range of mountains runs from south-west to north-east through both islands (Map 60 in Atlas). In South Island the mountains are more massive, but in North Island they present more interesting features. For example, they contain a number of active volcanoes and some high volcanic cones. Geysers and hot springs are found distributed over a region that was recently disturbed by volcanoes.

Sec. 596. Climate. New Zealand, on account of its more southern position and the nearness of all its parts to the ocean, has a cooler climate than Australia, and is not subject to extremes. Indeed, in all parts the winters are mild and the summers cool. As the Dominion is in the region of the strong westerlies, the west slopes of the mountains receive abundant rainfall throughout the year, whereas the east slopes receive not more than ten or twenty inches (Maps 3 and 4 in Atlas). On account of the difference in rainfall the western parts of the islands are covered with dense forests, while the stony character of the drier eastern slope is relieved only by growths of scrub and tussock grass (Map 65 in Atlas).

Sec. 597. Industries.—New Zealand is, like Australia, primarily a pastoral country, and its great herds of cattle and flocks of sheep are its chief source of wealth. Like Australia, too, New Zealand has recently turned her attention to dairying, and her cheese and butter have already gained a place on the British market, as well as on those of Canada and the United States. Wheat, oats, and barley are grown to a considerable extent along the east coast of the South Island. The only other important industry is mining, and the chief minerals are gold, coal, and a fossil, called Kauri gum, the origin of which is worthy of mention. That part of North Island in which this gum is found was formerly covered by pine forests; and as the wood of these trees decayed, the resin was left behind and was gradually buried in the earth, from which it is now dug. Kauri gum is unsurpassed for the making of varnishes.

Sec. 598. People. The natives of New Zealand, called *Maori*, are the most intelligent of all the natives of the Pacific Islands. In contact with the Europeans they learn the ways of civilization very rapidly, and they always send representatives to the New Zealand Parliament. The immigrants to this Dominion have been almost entirely British. To-day they number about one million.

Sec. 599. Cities.—*Auckland*, in the North Island, is the largest city, and *Wellington*, also on the North Island, but at the extreme southern end, is the capital. Both are situated on the coast and are commercial and manufacturing centres.



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Key to Pronunciation

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ā as in fate	ē as in mete	ō as in note
ä as in far	é as in her	ö as in move
â as in fall	i as in pin	ó as in off
á as in ant	ī as in pine	u as in tub
ã as in fare		ū as in mute
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BRITISH COLUMBIA

SUPPLEMENTARY CHAPTER

Prepared by V. L. Denton of the Provincial Normal School, Victoria, B.C.

In the body of the book, pages 248 to 259, the province is treated in a general manner; in this Supplement particular districts are described. These are: (1) The Island Fringe; (2) The Coast District, Mainland; (3) The Interior Plateau; (4) The Okanagan Valley; (5) The Kootenay District; (6) The Lands of Central British Columbia, Prince Rupert to Lucerne.

The Island Fringe

Outside the deeply indented coast-line of British Columbia lie many islands. These are the partially submerged tops of a mountain chain, sometimes spoken of as the Island Range. Vancouver Island and the Queen Charlotte group are the principal islands in size and commercial importance. Together with the smaller islands, they form an unbroken screen to the mighty Pacific swell and provide hundreds of miles of land-locked waterways.

Vancouver Island

Position and extent.—Paralleling the southern side of the Straits of Juan de Fuca, the rugged Olympic Range of Washington State bends around to the north-west, terminating at Cape Flattery. From the hollow palm thus formed, Vancouver Island extends northward a distance of 270 miles. Its average width is 50 miles and it exceeds 15,000 square miles in area. It is equal in size to Belgium, and is twice the area of Wales.

Surface features.—Mountain ranges run the length of the island, sloping steeply to the Pacific, but more gently to the inland or eastern side. The coastal plain thus formed varies in width from eight to fifteen miles, and is crossed at intervals by rivers

and small streams which come down from their lake sources in the mountains of the interior of the island.

The west coast from the Strait of Juan de Fuca to Cape Scott is deeply indented. Due to the strong tides and great waves of the Pacific, the coast-line presents a rugged wave and wind-swept aspect. Back from the shore the dome-shaped hills rise in increasing height to the higher mountains of the interior of the island. This seaward slope of the island chain is covered from base to top by a dense forest, giving to the whole that blue-clad appearance so characteristic of the British Columbia mountains.

Many large and beautiful lakes occupy the mountain clefts and valleys, and every important stream on the island has its source in some one of these. Sooke and Goldstream Lakes are so situated that they provide a never-failing water supply for the city of Victoria and its adjacent municipalities. Shawnigan Lake is a summer resort. Cowichan Lake provides sport for rod and gun. Cameron, Sproat and Great Central Lakes are the haunt of summer tourists essaying the Georgian circuit. Nitinat Lake is the centre of the aeroplane spruce district. There, in war-time, were cut those great logs of clear spruce from which the Allies fashioned aeroplane frames. Experts have decreed this region to be the finest spruce forest on the island. Farther north, Strathcona Park has been set aside as a reserve. It is 800 square miles in area and crowns the highest portion of the island. A veritable maze of lakes and streams combine to flow seaward by the Campbell River, the largest on the island. A few miles below the lower Campbell Lake, the river plunges down one hundred feet in a direct fall. The Elk Falls have an estimated 60,000 horse-power which could be turned into electrical energy. In time they will be harnessed and large industries will be established in the neighbourhood.

Industrial Areas.

(*a*) *Victoria City and district* include that part of the island south of a line drawn from Saanich Arm to Jordan River. Victoria is the capital of the province and contains the beautiful Government buildings, and the official residence of the Lieutenant-Governor. The city encircles the small land-locked James Bay, which is used as an inner harbour for coastwise shipping. Its southern slope faces the Strait of Juan de Fuca and the Olympic range in Washington State. A huge breakwater has been recently completed at Ogden Point at a cost of over $3,000,000. It is 2500 feet in length and provides an outer harbour for the largest trans-Pacific vessels. The main railway line runs north from Victoria along the east coast to Courtenay, with a branch from Parksville to Alberni, and another from Duncan to Cowichan Lake. The Canadian National has a line under construction into the Cowichan

FIG. 237. SKETCH MAP OF VANCOUVER ISLAND

Lake and Port Alberni districts. Inter-urban electric lines spread out through the Saanich peninsula, and in this manner the fertile districts of the southern half of the island are brought within easy reach of the capital, and merchandise is readily distributed. Five large lumber mills, three shingle mills, a roofing-paper plant, a soap works, and a paint factory are situated at favourable points around the inner harbour. A number of wooden vessels were built here during the war, but this industry has not been able to survive the subsequent depression in trade.

Victoria is essentially a residential city. The healthful situation, the many small bays which make it almost sea-girt, the moderate rainfall, and the mildness of the climate, all tend to this end. The beauties of the city are known far and wide, and large numbers of tourists visit Victoria each year. People from the prairies like to spend the winter season in Victoria; tourists seek Victoria in summer to escape the heat of the interior plateau.

Adjoining the city on the north lie the fertile lands of the Saanich peninsula, providing a never-failing supply of dairy products, poultry, fresh vegetables and fruit. The well-known Gordon Head district exports car-loads of strawberries to far prairie points. At heavy expense the city secured an abundant supply of pure water from Sooke Lake watershed, so that the whole lower portion of Vancouver Island, comprising a population of over 60,000, has an adequate supply of water for domestic purposes as well as for irrigation projects already in course of development. Engineers have harnessed the Jordan River, and electric power is distributed through the city and surrounding municipalities.

On the shores of the spacious Esquimalt harbour one dry-dock is in use and a larger one is under construction. The new dry-dock will measure 1150 feet in length, 120 feet in width, with a depth of 40 feet over the sills. The largest Pacific liners may then enter for repairs, and it is expected that Esquimalt will become one of the large ship-repair depots of the Pacific Coast.

At Tod Inlet, and across the arm, at Bamberton, huge cement works give employment to many workmen. When in full operation, the annual output is one and a half million sacks of cement, and the product is sold throughout the province.

A short distance west of Esquimalt a large deposit of pure talc has been opened up. When ground fine it forms the base of the well-known talcum powder of commerce, and is used extensively in the manufacture of fire-brick lining for blast furnaces.

(*b*) *The west coast.* Fishing is one of the chief industries of the west coast of the island. Salmon, pilchard, herring, and cod are the principal fish caught. Salmon canneries are located at Sooke, Kildonan, Tofino, Nootka, and six other places. Power boats

from Ucluelet troll for spring salmon on the fishing banks off Barkley Sound. During the fishing season the daily catch of this variety is well over thirty thousand pounds. These fish are iced and shipped to Victoria, Vancouver, and Seattle markets. Whaling is carried on out of Kyuquot.

Just inside the entrance to Barkley Sound is Bamfield, where the Pacific Cable seeks the sea floor on its way to Fanning Island and Australasia.

[*Courtesy of J. Howard Chapman, Victoria.*

FIG. 238. TOTEM POLES AT ALERT BAY

At the head of the Sound, stretching far inland, is Alberni Canal, almost cutting the island in two. The Alberni district is a lumbering area of growing importance, and Alberni is an export centre for the trans-Pacific lumber trade with Australia and the Orient.

The glory of Nootka Sound vanished with the disappearance of the sea otter. An Indian village still encircles Friendly Cove. Marble is found near by.

At Port Alice, on one of the arms of Quatsino Sound, is located a large pulp mill.

(*c*) *The east coast.*—(1) Lumbering. From Cowichan Lake and Valley to Nimpkish and Alert Bay the giant firs and cedar, spruce and hemlock are being felled. This is one of the great logging districts of the province. By river and rail the logs are brought to tide water in a hundred protected bays. At Genoa Bay,

Chemainus, Qualicum, and Nanoose Bay they are sawn into the lumber of commerce; at other places, tugs tow the booms across the gulf to the mills on Burrard Inlet and the Fraser.

(2) Coal-mining. Tremendous reserves of coal are known to exist on Vancouver Island. Nanaimo, Ladysmith, and Cumberland are the centres of this industry. The coal is of good bituminous grade; that mined at Cumberland reaches tide water at Union Bay, where ocean vessels come to renew their fuel supply. Some coke is also produced from this coal. The mines in and around Nanaimo ship to Victoria and to Vancouver. Ladysmith is the port which the Extension coalfield utilizes. These mines lie eleven miles north of the town and somewhat inland among the hills at the foot of the main Beaufort range. New mines open up from time to time; the existing market alone determines the yearly tonnage, which is now well over the million mark.

(3) Agriculture. The broad valley lands of the Cowichan River have their centre at Duncan. Mixed farming prevails.

The Comox Valley is a second fertile area, of which the city of Courtenay is the supply centre. Dairying is carried on in the bottom lands and mixed farming on the bench lands.

The lands near the Campbell River mouth and the fertile area of the Salmon River district are in the process of development. The latter lie 200 miles north of Victoria and 130 miles west from Vancouver. Forty thousand acres of clay-loam and silt land await the pioneer.

Altogether 1,000,000 acres of land (one-tenth of the island's area) are suitable for agriculture. Only a small fraction of the total is at present under the plough.

The Gulf Islands

These vary in size from tiny wooded knolls to islands of considerable area and importance. All are forested, and a few small saw-mills take care of the local requirements. On *Pender* and *Salt Spring Islands*, dairying and mixed farming is the chief industry. *Mayne Island* specializes in early tomatoes. On *James Island* a large powder plant is in operation. *Denman* and *Hornby Islands* are well settled, and dairying is the chief occupation. *Texada Island* is a rocky ridge thirty miles in length, occupying the northern end of the Gulf of Georgia. Gold-copper ores are mined near Vananda at the northern end. On the west side there are good agricultural areas around Gillies Bay. Marble quarries have been opened at the southern end of the island. *Savary Island* is a summer resort.

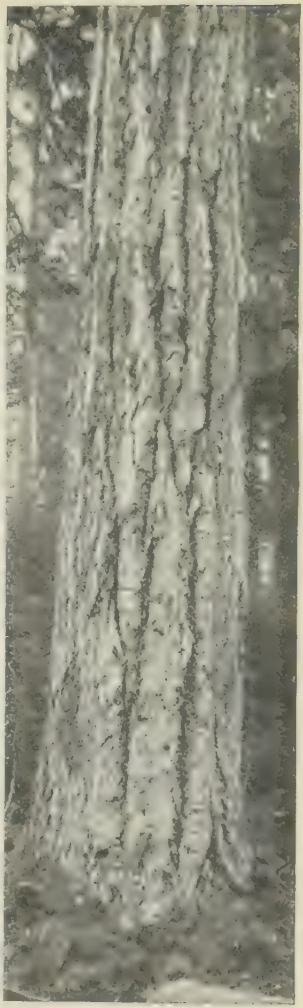
The Queen Charlotte Islands

The Queen Charlottes lie off the mouth of the Skeena. There are two large islands, Graham and Moresby, and many smaller islets. Dixon Entrance separates the group from the Alaska tongue, while Hecate Strait forms a broad passage-way between the islands and the mainland. Mountain ridges of moderate height extend throughout Moresby and the western part of Graham Island. East of Rennell Sound, the hills flatten out, and there is much lowland and muskeg. The land slopes gradually to the north-east. The climate is mild, the rainfall heavy, and the vegetation dense. The spruce, cedar, hemlock, and yellow cedar or cypress are the principal forest types. The trees grow to a tremendous size with tall, straight, clean trunks.

Graham Island.—Lumbering is an important industry. Camps are located around Masset Sound and Skidegate Inlet.

Whaling is carried on at Naden Harbour. Salmon canneries are located near Masset. Halibut fishing is engaged in to some extent, and the bulk of the catch finds its way to Prince Rupert.

Large coal deposits have been located at Cowgitz and vicinity. While the lowlands of Graham Island are of large area, the nature of the soil is such that clearing is difficult and expensive, and under-draining is necessary. But wherever tracts have been well cleared, fine fodder, hay, and vegetable crops are grown. Dairying will some day be the chief industry of this island. Settlements are located around Masset Sound and



[*Courtesy of Leonard Frank, Vancouver*

FIG. 239. DOUGLAS FIR

along the inlet. Masset is the chief trading centre. The lands of the east coast from Tlell to Skidegate have been well settled, and an experimental farm has been conducted at Lawn Hill. Skidegate is a fishing centre.

Moresby Island is more mountainous and has a comparatively small amount of coastal plain. Sandspit (in the north) is the principal settlement. Lumber camps are busy on Cumshewa and Selwyn Inlets. Spruce for aeroplane manufacture was shipped from these camps during the war. Rose Harbour is a whaling station.

The Coast District—Mainland

The Coast District of British Columbia extends from the 49th parallel and Boundary Bay to Stewart at the head of Portland Canal, and from the sea to the crest of the Coast mountains. It is one of the most deeply indented and most intricate coast-lines in the world, providing many thousand miles of deep, protected waterways and innumerable harbours. Comparison may be made with the coasts of southern Chili, southern New Zealand, Scotland, and Norway, where similar features prevail. Huge glaciers, at some time in the distant past, gouged out these winding, deep-cut, narrow valleys, which are now flooded by the ocean water. The coastal plain is very narrow; in many places the mountains come down abruptly into the sea, and a vessel may safely pass close to the sheer rock walls. With the exception of the Fraser, Skeena, and Nass, the rivers draining this westward slope are short, rapid, dashing mountain torrents, often providing electrical energy for near-by mines or mills. The rainfall is heavy, between 60 and 100 inches yearly; the climate is mild and not subject to extremes of temperature. This produced a dense forest which covered the entire region.

The Lower Fraser Valley.—This is a long V-shaped delta land and flood plain, the only one of its kind on the whole coast of the province. From the apex at Hope, where the mountain walls spread apart, to the Gulf of Georgia is a distance of 70 miles. From the north shore of Burrard Inlet to Boundary Bay is 25 miles. Through this area of 900 square miles runs the Fraser, greatest of British Columbia rivers. At New Westminster the river divides into two channels, which enclose low-lying alluvial islands, the principal ones being Lulu Island and Sea Island. The channels are kept clear of the accumulating silt by dredging, and by the construction of jetties. The river is navigable to Yale.

Industries.—The lands of this valley area may be divided into two classes—the rich, heavy bottom lands adjoining the river, and the lighter bench lands rising to the mountains. On the former, dairying is the chief industry; on the latter, mixed farming is carried on. On the north bank of the Fraser, from Pitt Meadows

to Yale, the bench lands produce much fine fruit and quantities of early vegetables for the city markets near by. Apples, pears, plums, and cherries grow well; berries, particularly raspberries and loganberries, are a feature crop of this part. The higher lands of the Chilliwack district to the south also produce quantities of fruit, while the potatoes from this district are making a name for the growers. Hops of fine quality are grown.

In the Sumas Lake region the provincial government has under way a reclamation project which will soon set free 30,000 acres for the plough. These lands should be the equal of any in the province when once under cultivation. Much dyking has been done on the low-lying islands at the mouth of the Fraser. Heavy hay and fodder crops are grown, while big barns and fine houses dot the landscape. From Chilliwack to the gulf, dairying is the principal industry. Creameries are located at Chilliwack, Clayburn, and Vancouver. Butter and cheese are produced, while condenseries at Sardis and Chilliwack provide a market for the rapidly increasing supply of milk.

One of the more recent developments has been the rapid growth and establish-

[*Courtesy of Leonard Frank, Vancouver.*

FIG. 240. RED CEDAR

400 years old and still growing

ment of large poultry ranches. The mild climate, the many well-drained, protected slopes, the supply of mangels, grain, and milk in abundance, together with a large city market and general warehouse centre—have been factors in the rapid development of the poultry industry.

The Dominion Government maintains at Agassiz an experimental farm which serves these valley lands of the lower Fraser.

Lumbering.—Into the valley of the lower Fraser come the Pitt, Harrison, and Stave rivers from the mountain-filled lakes, which lie cradled in the giant valleys of the Coast mountains. Throughout this watershed, magnificent forests of fir, cedar, and hemlock are found, and the logger is at work. Down the rivers come the logs to the Fraser. Here the big lumber mills are found at and near tide water, and the lines of the Canadian Pacific Railway and the Canadian National Railways. Ideally located in fresh water, and free from the ravages of the teredo, the Fraser mills are yet open to the deep-sea tonnage for ocean export as well as ready for inland prairie commerce via the great trans-continental railways. Large mills are found at the following points—Mission, Haney, Hammond, Coquitlam, Eburne, and New Westminster. The Fraser mills of the Canadian Western Lumber Company, near New Westminster, are the largest in the province.

Transportation.—It is natural that the valley lands of the lower Fraser should have early attracted settlers. In 1859 the gold rush brought the miners to the sand-bars above Yale. In 1863–4 the Yale road was built. Even before the completion of the Canadian Pacific Railway in 1885, many farms were being cleared of the heavy timber which then covered the land. With the laying of the steel rails, however, the destiny of the lower Fraser was assured. A market for all the produce was now provided, while the prairies welcomed the lumber removed. A city began to grow at the rail end on Burrard Inlet, the winding skid roads giving way to broad paved streets. The flashing axe cut deeper into the forests, the plough turned over the black humus of centuries past, and small villages grew up along the railway from Vancouver to Yale. On the river, small stern-wheel steamboats plied up and down and across, using New Westminster as their base. Thus the north shore of the Fraser was well served by land and water.

But the rich lands to the south needed better facilities than a ferry or river boat. So in 1904 the big bridge was completed at New Westminster. The bridge cost a great deal, and tolls were charged at first to help pay for the cost. It is a two-level or two-deck bridge. Above is the wagon road and footway; below is the railway track. Into New Westminster came the Great Northern from Seattle. Then the British Columbia Electric built a long

FIG. 241. SKETCH MAP OF THE LOWER FRASER

tram-line from Vancouver to New Westminster, crossing the big bridge and threading the valley lands to Chilliwack. Eventually the Canadian National Railway came down the Fraser, followed the south bank of the river to Port Mann, and thence into Vancouver across the same bridge. Every section of the valley area is thus connected by rapid means of transportation with the two city areas, with the ocean shipping, and with the interior of the province. Many miles of macadamized roads have been built, and the producer may take his supplies to market in his own motor truck.

New Westminster, often called the Royal City, was begun in 1859 by the Royal Engineers, and was for a few years the capital of the province. Here are located the Dominion penitentiary, and the mental hospital. The city has a population of 17,000, and acts as a supply centre for the farming lands near by.

Lumbering is the chief industry. There are four saw-mills, four shingle-mills, a shook-mill and a plant making laminated material. There are several machine shops and a foundry. Among others these may be noted—a large tannery, a cigar factory, two fruit and jam factories, and a large cordage factory, the only one of its kind in the province. The city has enjoyed a steady growth and stands third in size and importance in the province.

Vancouver City.—Vancouver is situated on a broad headland between Burrard Inlet on the north and the Fraser River on the south. The waters of the inlet are landlocked with gently sloping foreshores. The accompanying map shows the adjacent residential municipalities of Point Grey, South Vancouver, and Burnaby. The whole may be called Greater Vancouver, with an estimated population of 200,000. Including Stanley Park, the city of Vancouver and its adjoining municipalities cover an area of eighty-eight square miles. Let us note why so many people live in this area, and thereby learn those causes which create a large city anywhere.

(1) Vancouver has a large, deep, sheltered harbour; the largest vessels may enter and find miles of docks to receive their cargoes. Return cargoes are awaiting the vessel when unloaded. Ample warehouse accommodation facilitates the handling of all commodities.

(2) Two great railways make this city their ocean terminus on the Pacific. A third sends a branch line up from the State of Washington. Large passenger depots and freight sheds have been built to care for the continental traffic which has developed.

Many people are engaged in this export and import trade, which a terminal seaport must by virtue of its position endeavour to handle. Cities, like stores, have competitors. Seattle to the south is one near by, while Prince Rupert, Portland, and San

Francisco are more distant rivals. Each desires a large trade. That city will win the trade whose citizens by their industry provide the safest, speediest and cheapest means for handling the freight which offers. Vancouver is forging ahead because these conditions are being well met.

(3) Industries. Wherever lines of transportation meet, industries are often established. This is particularly true where sea lanes meet rail ends. Raw products can be assembled by cheap water route; the finished articles may be sent out by either rail or boat as the case may demand. As a result fourteen lumber mills and fifteen shingle mills are in operation along the city's shore-

[*Courtesy of Vancouver Publicity Bureau.*

FIG. 242. GRAIN ELEVATOR AT VANCOUVER

line. Other wood-working plants are—sash and door factories (twelve); brooms and broom-handles (three); manufactories of boxes (four); wood pipe (three); cooperage works (two). Altogether over sixty manufacturing plants in Vancouver city, some of them employing 300 men, are busily turning the logs into finished articles, for the markets of the world.

In the early days the raw material was close at hand, now the log booms come many miles. The mills grow up near big railway terminals of the transcontinentals and the long piers of the steamship companies. It is cheaper to bring the logs to the large export centre than to build the mill at the source of supply. From the Vancouver city limits eastward along the south shore of

[*Courtesy of Leonard Frank, Vancouver.*

FIG. 243. VIEW OF VANCOUVER CITY AND HARBOUR

Burrard Inlet to Port Moody and westward along the north shore of the inlet to North Vancouver another sixteen lumber and shingle mills are in operation. The Vancouver district is one of the great lumber manufacturing centres of the Dominion.

Another good example of a strategically located industry is the sugar refinery. From far-away Cuba, from Peru, from the islands of the Indies, the raw sugar is brought in large freighters. It is made fit for use at the refinery; from here the sugar is sent to all parts of the province and to the prairies as well.

(4) The mills and the mines throughout the province need machinery and supplies of many kinds, such as engines, tools, wire rope, belting and saws. Some place must act as a centre of supply. Vancouver is the centre to which people send.

Many lines of coastwise vessels make Vancouver their home port. These carry many kinds of goods to the people of the island fringe and to those at work in the forests, mines and fisheries of the long coast strip. Vancouver is thus a distributing centre for a large area.

Into Vancouver come many products from Japan, China, and India for the use of the people of the province as well as for the Canadian people at large. Much of the raw silk destined for Montreal enters Vancouver on its way to the Atlantic seaboard. Much of the rice, the spices, the bamboo and wicker work, and the china destined for Canada comes in through Vancouver. This handling of cargoes means work and employment for many people, and the city grows continually in population and importance.

(5) A large city is fortunate to be located near an unfailing water supply. Vancouver is well served in this respect. Across the inlet along its northern shore rise the mountains of the Coast

[*Courtesy of Leonard Frank, Vancouver.*

LOOKING NORTH AND NORTH-EAST

Range. From Capilano and Seymour creeks the purest of water is led by pipes under the harbour and through the city mains. At Lake Buntzen near the north arm of the inlet, and at Stave River abundant hydro-electric energy is developed. Power is sold as far south as Blaine and Bellingham.

With this ample supply of cheap electrical energy at hand, the last ten years has seen a steady increase in the number and variety of manufacturing plants located in greater Vancouver. A large boot and shoe factory gives employment to many operatives, and its product is sold throughout the province. Fourteen shops of varying sizes manufacture boilers, either marine or stationary; six firms are engaged in printing, and are able to make books and do book-binding. Still other plants make castings and turn out brass fittings. Several shops are engaged in sheet metal work, while others make furnaces. There are flour-mills, furniture factories, manufacturing jewellers, and one plant where white lead is made. These do not exhaust the list by any means, but may be taken to indicate the large variety of articles which are now being manufactured within the Vancouver industrial area.

(6) The rich valley lands of the lower Fraser supply each year an increasing amount of food stuffs for the industrialized area of greater Vancouver. These farm-lands at the back door provide the city people with fresh produce at moderate prices.

(7) Vancouver bears to Western Canada the same relation that Montreal bears to Eastern Canada. Its future is linked with the growth of the Western Provinces and the Dominion as a whole. As Canadian trade increases, so will that of the port of Vancouver.

Accordingly, the Dominion Government has erected a large terminal elevator on the inlet to facilitate the export of Alberta

grains during the winter months. This grain is transported by sea via the Panama Canal to European points. When freight rates were lowered, the export trade increased. And now Vancouver ranks first among the grain exporting cities of the Pacific coast of America.

North Vancouver is an industrial city on the north shore of the inlet. Here shipyards are engaged in the building and repairing of vessels. Ferries connect with Vancouver on the south shore of the inlet, and a traffic bridge is being erected.

From Burrard Inlet to Portland Canal

Howe Sound.—At Britannia Beach is located a large copper mine. For some years the annual production has been around 14,000,000 pounds. The ore has been concentrated at the Beach and then shipped to Tacoma. A new concentrating plant has been erected, and it is expected to double the previous output. An interesting aerial tramway brings the ore to the beach.

Squamish at the head of the sound is the ocean terminus of the Pacific Great Eastern Railway. Ascending the Cheakamus canyon, the railroad passes through the Coast Range along Pemberton Meadows, past Anderson and Seton lakes, and down to Lillooet on the Fraser. A rich timbered area is traversed by this part of the road, and the logs are delivered by the railway at Squamish. From Lillooet the road crosses the Fraser and ascends the inland plateau through Clinton and on northward to Soda Creek, where it strikes the Fraser again. By this means the range lands of the dry belt are brought within a few hours of tide water. Steel is now (1923) at Quesnel, and indications are that the road will soon be completed to Prince George, connecting with the Canadian National Railways. The road is provincially owned, and opens up to settlement large areas of the interior plateau.

Across the sound from Britannia Beach is the large pulp mill at Woodfibre, with a daily capacity of 100 tons of sulphite. The product is thoroughly dried and put up in 320-pound bales for export to the paper-making plants in the United States, Great Britain, New Zealand, and Japan.

Other pulp and paper mills: eighty miles north of Vancouver on the mainland east of Texada Island is the Powell River mill. Both sulphite and mechanical processes are used to reduce the wood to pulp, which is manufactured into paper at the plant. The capacity is about 250 tons per day. An electric power installation develops 24,000 horse-power from the river emptying Powell Lake.

At Ocean Falls on Cousins Inlet, a branch of Dean Channel (380

miles north of Vancouver), there is still another pulp and paper plant making 200 tons of news-print and kraft paper daily.

Swanson Bay pulp-mill (45 tons daily), 100 miles south of Prince Rupert, is located on the east side of Graham Reach, opposite Princess Royal Island. Barges carry the output to Prince Rupert.

It is the practice with the majority of pulp-mills to operate a saw-mill in order to take full advantage of the larger timber. In some cases a shingle-mill and a box factory are found to be necessary adjuncts of the parent pulp-mill. Pulp and paper mills located on the coast of British Columbia are particularly fortunate in the possession of unlimited water-power which furnishes abundant electrical energy at a minumum of cost. We may expect to see a large development of this industry during the ensuing decade.

Prince Rupert lies 500 miles north of the mouth of the Fraser and the industrial area surrounding Burrard Inlet. Into this great coast strip extend inlets and canals innumerable. Salmon canneries have been built at favourable points and in summer add their activities to those of the logger and the lumberman. At Smith and Rivers Inlets ten canneries are in operation; at least ten more dot the protected passageways from Bella Coola to the Skeena River mouth. Twelve canneries pack the salmon which spawn in the Skeena watershed, and four canneries operate at the mouth of the Nass. A million cases a year are exported. Employment is given to over 6,000 people.

In addition to the pulp-milling, lumbering and fishing, the northern coast district is particularly rich in minerals. The copper mine at Britannia Beach in Howe Sound has already been mentioned. Two large copper deposits are being worked in the north. The Belmont-Surf Inlet mines are located six miles from the head of Surf Inlet on Princess Royal Island. The ore is concentrated and shipped to the smelter at Anyox.

The largest copper mine in Canada is located at Anyox on Observatory Inlet. Here a town of 3,000 people has grown up around the big smelter of the Granby Consolidated Copper Company. Behind the town lie the hills from which the ore is taken. Electric light and power for local use is generated by the mining company. Railways connect the mine with the smelters and wharves. Development began in 1912, and the smelter was "blown in" in 1914. Coke ovens have been recently installed, and the company's investment has passed the ten million dollar mark.

The Dolly Varden silver mines are located on the Kitsault River, which flows into the head of Alice Arm.

At the head of Portland Canal lies the town of Stewart, the centre of a highly mineralized gold-silver area. The rich Premier mine is located to the north about fourteen miles up the Salmon

[*Courtesy Canadian National Railways.*

FIG. 244. INDIANS SMOKING SALMON ALONG THE BULKLEY RIVER, B.C.

River valley. A giant aerial tramway, one of the longest on the continent, connects the mine with ore docks at Hyder, a small village on the Alaskan side of the boundary line and a short distance below Stewart. The Premier mine has developed into one of the richest gold-silver mines in the province.

From Ocean Falls to Stewart, and including the Queen Charlotte Islands, the industrial development is largely tributary to the chief trading centre of the north, Prince Rupert. This city has been well named the Grimsby of the Pacific. From the fishing banks off the Queen Charlottes come the halibut boats loaded to capacity. Other flat fish of the sole, brill, and plaice varieties are also landed in large quantities. To take care of this growing trade, the largest cold storage plant on the continent engaged in fish freezing has been erected. Here 14,000,000 pounds of fish may be held while awaiting shipment by rail to interior points. Four vessels may unload at once, and 30,000 pounds of fish per hour have been received at this great plant. Several thousand tons of herring are annually caught, salted, and exported to Japan and China. For some years the total value of fish landed at Prince Rupert has exceeded four million dollars.

In addition, it may be noted that twenty-eight canneries are located in the district adjacent to Prince Rupert, and that the bulk of their pack finds its way to this mart.

The city is built on the northern end of Kaien Island, twelve miles north of the Skeena River mouth. Here a long, natural harbour is formed by the protecting shores of Tsimpsean Peninsula and Digby Island. The port has been developed as the ocean terminus of the northern branch of the Canadian National Railway system. Large wharves and a floating dry-dock have been built and the trade of the region is growing rapidly. Saw-mills provide employment; vast areas of virgin timber stretch back from the deeply-cut coast-line. Vessels connect regularly with the mining towns on Portland Canal and Observatory Inlet, with the Queen Charlottes, and with Vancouver and Victoria.

The Interior Plateau

Extent.—The Interior Plateau of British Columbia in reality comprises that portion lying between the Coast Range on the west and the Rockies on the east. It is widest in the southern part of the province and gradually narrows to the north where the Rockies draw nearer to the Coast Range. For our purposes it will be best to restrict the use of the term, Interior Plateau, to the drainage basin of the Fraser and the Similkameen Rivers; or, to locate this region in another way, that portion of British Columbia

walled in on the west by the range of the Coast mountains and the Columbia Range on the east, and extending from the boundary northward in a great ellipse to the vicinity of Prince George.

Topography.—Throughout this immense district one is impressed by the clear-cut manner in which the forces of upheaval and of denudation have left their marks. Tongues of the ancient Cordilleran glacier here and there pushed their irresistible way to the sea. (By the Skeena Canyon; Bella Coola and Dean Channel; by the Fraser gap.) The old plateau has been scoured and worn until huge, deeply cut valleys now occur where once prehistoric man gazed on an apparently endless, gently sloping expanse. So deep are the valleys that the higher lands remaining, or what we may call the *original* plateau levels, now appear as mountains, often rising 1,500 to 2,000 feet above the floor of the present valley level. A characteristic of many of these mountains is the uniform level of their tops. Many of the larger mountains appear to have been sheared off by some giant knife, so regular is the sky-line of their crests. Once the climber mounts the crest, a grass-strewn, level expanse greets the eye, the remnant of the ancient plateau land. Down to the main valleys of the Similkameen and Fraser Rivers come many lateral tributaries. These creeks or draws are themselves deeply sunk, with sharply sloping sides.

The whole district is a great range land. Thousands of acres of grass land cover the slopes down to the river banks. Pines, in scattered array, dot the hillsides. In summer, the heat radiating from the sun-baked earth makes irrigation on the higher benches a necessity; in winter, prairie cold vies with brilliant sunshine to make this one of the health resorts of Canada.

Drainage.—This district is partly in the drainage area of the Columbia River system. The valleys of the Similkameen and Tulameen drain off across the boundary to join the Okanagan. The drainage divide or height of land which separates this slope from that of the Fraser extends from a little south of Merritt eastwards to the hills bordering Okanagan Lake. The lands thus enclosed are bordered on the west by the formidable Hope Mountains, an offshoot of the Cascade Range from the State of Washington and a part of the Coast Range. No low pass exists through the British Columbia part of these mountains. On the north, the valley of the Similkameen merges almost imperceptibly into a rolling plateau where small lakes and streams drain off to the Thompson river.

The Fraser River system is the largest in British Columbia. The area drained comprises 98,000 square miles and extends from the crest of the Rockies on the east to the Coast Range on the

[Courtesy Canadian National Railways.

FIG. 245. THE FRASER RIVER CANYON AT YALE

west. On the north, an irregular water-parting separates the Fraser drainage area from those of the Skeena and Peace Rivers. To the south, the northern sweep of the Columbia constricts the south-eastern part of the Fraser basin, and the watershed of the Okanagan Similkameen sections further confines its whole southern outlet. The Fraser basin then resembles a huge balloon with an elongated neck bent to the left or west where the Fraser rushes out through the Coast Range to the Gulf of Georgia. Globular-shaped drainage areas often exist where plateau conditions are well defined: comparisons may be made with the general shape of the Congo and Zambesi river systems in Africa. As the waters collect over the whole area into one main stream the drainage basin narrows, suddenly the river turns to right or left and dashes its way by canyon and waterfall through a narrow defile in the obstructing mountains. On the Fraser, this occurs at Lytton (altitude 687 feet), where the river cuts through the Coast mountains forming a canyon 67 miles long, and drops 480 feet. Below Yale the valley widens again, the mountains retreat, and the river flows sluggishly through broad flats which were once periodically flooded, but are now protected by dykes. These are the lowlands or delta lands of the Fraser. The cut scoured by the river through the mountains is made use of by man to secure an easy gradient for his transportation of commodities, and two transcontinental railways have blasted out road beds along the sides of the rocky gorge which forms the river's valley through the Coast mountains.

The Canadian Pacific Railway in crossing the province has followed the Fraser to Lytton, then, swinging to the right, it has utilized the valley of the South Thompson to the Shuswap Lakes. Circling their southern arms, the railway ascends the Malakwa valley to Craigellachie, where, by means of Eagle Pass, the road descends to the Columbia. The remaining portion of the main line follows the rivers in that drainage basin. The Canadian National Railways (southern branch) follows the Fraser Canyon and the South Thompson River as far as Kamloops; then, turning to the left, ascends the North Thompson to its head, only to strike the upper Fraser at Albreda, and crosses the Rockies through the Yellowhead Pass. It may be considered a Fraser River rail route across British Columbia. The larger portion of the Pacific Great Eastern Railway traverses the Central Fraser valley from Lillooet to Prince George. In a similar manner the northern branch of the Canadian National line occupies the valley of the upper Fraser in its route across the province.

The sources of nearly all the tributary streams of the Fraser system are in long narrow lakes, which were originally formed by the damming up of the ends of mountain gorges. These lakes

are deep, clear, and well stocked with fish. The bordering mountain sides are forest clad.

The Interior Plateau by sections :—

(1) The valley of the Similkameen occupies the slope to the south. This is a true dry belt area, the sloping valley lands are largely grass covered, while the higher elevations show fair stands of spruce and jack-pine. Cattle-ranching has for long been the chief industry; thousands of cattle range the hills of the Similkameen and graze the tributary valleys. Mining is growing in importance. At Princeton coal mining is carried on. Copper Mountain, twelve miles distant, is yielding its ores to a huge concentrator. The product is smelted at Trail. Hedley is situated on the Similkameen at the confluence of Hedley Creek. It is the supply centre for the gold mines near by. Forty miles below Princeton is Keremeos, the centre of a large fruit-farming area located on wide benches sloping to the Similkameen River. Roads connect with the southern Okanagan valley. Transportation had long been a problem in the Similkameen district until the Kettle Valley line was built from Penticton to Hope. The Hope mountains formed a massive barrier, and shut off ready access to the large coast markets. The railway was finally put through the Coquihalla Pass (altitude 3,664 feet). While the gradients are quite heavy, the Kettle Valley line gives rail communication with the coast district on the one hand and with the Okanagan and Kootenay districts on the other.

(2) North of the Similkameen lies the Nicola valley, draining to the Thompson. The arable lands have been occupied and mixed farming is carried on upon the lower benches, cattle ranching and sheep raising on the higher lands. Near Merritt coal-mines are in operation. The annual production from the Merritt-Princeton fields approaches 200,000 tons; 300 men are employed and the tonnage is limited to the existing market. A branch railway line connects with the Canadian Pacific at Spence's Bridge.

(3) The Thompson River and watershed. From Lytton to Ashcroft, a distance of fifty miles, the valley of the Thompson is narrow and precipitous. The river dashes down to meet the Fraser through canyon and gorge. High above, like spider threads along a bank, may be seen the main lines of the transcontinental railways on their way to tide water. Ashcroft has long been a centre of trade with the Cariboo district. The great Cariboo waggon road passes through here on its way to Quesnel and Barkerville. The Canadian Pacific Railway rendered the Lytton-Yale portion useless, and now the traveller sees but a section here and there of crumbling crib work hanging precariously to the sheer walls of the Fraser canyon. But for fifty years that portion of the Cariboo road north

of Ashcroft has been the great trade highway into the central Fraser valley. To-day the steel rail threatens the existence of the remaining portion. But the lands around Ashcroft were found to be marvellously fertile; irrigation systems have been installed and the district is now famous for its potatoes. Cattle-ranching is carried on along the terraced benches.

At Walhachin fruit is grown, several hundred acres being under irrigation. From Savona to within nine miles of Kamloops the railroads parallel Kamloops Lake, a long, placid expansion of the Thompson River. The lake is said to be very deep and acts as a filter for the muddy waters brought down by the North Thompson. Here the valley of the Thompson widens out and for eighty miles to the Shuswap Lakes the river is a comparatively placid waterway with large stretches of arable bench lands extending back to the more distant hills. Cattle-ranching is the chief industry of this section.

Kamloops (6,000), the divisional point on two transcontinental railways, and the chief trade centre of the Interior Plateau, is located on the southern bank of the Thompson River near the junction of the North Thompson with the parent stream. Cattle-ranching is the chief industry of the wide-flung range lands tributary to the city. Sheep-raising is growing in importance, and a wool sale is held at Kamloops each June. In the fertile bottom lands of the South Thompson, hay and grain are produced. The acreage devoted to mixed farming is increasing, while fruit is grown where irrigation has been provided. A large cannery takes care of the tomatoes, and each year sees an increase in this type of produce.

Tranquille is situated on a bench overlooking the Thompson River and near Kamloops city. The provincial sanatorium for the cure of tuberculosis is located here. The rainfall is less than ten inches annually and the number of hours of bright sunshine is not equalled elsewhere in Canada. The excellent service performed by this sanatorium is known and appreciated both far and near.

North Thompson Settlement in the valley of the North Thompson has been under way since the completion of the Canadian National line. For the first hundred miles (Kamloops to Vavenby) the valley is wide with gentle slopes; beyond Vavenby it narrows. Mixed farming is the chief industry, stock-raising is second in importance. The hillsides are well timbered and saw-mills are at work. At Chu Chua there are large coal-seams.

Salmon Arm. As the higher lands which encircle the beautiful Shuswap Lakes are approached, the rainfall increases. The mountain slopes and valleys are heavily timbered, and saw-mills

[Courtesy Canadian National Railways.

FIG. 246. PLATEAU LANDS OF VANDERHOOF DISTRICT

are in operation at Chase and Notch Hill. On the gently sloping lands around the southern end of Salmon Arm fine farms have been cleared and fruit culture is the main occupation.

Routes.—The central Fraser valley lands may be entered by four routes: (1) the Cariboo waggon road from Ashcroft, via the Bonaparte valley to Soda Creek, Quesnel, and Barkerville; (2) from Lytton by waggon road to Lillooet and the Chilcotin; (3) by the Pacific Great Eastern from Squamish via Lillooet to Quesnel: (4) by the Canadian National Railways to Prince George and then by waggon road or river boat down the Fraser.

Industries.—Throughout these lands of central British Columbia, from Ashcroft to Prince George, from the Coast Range crests to the uplands of the Cariboo mountains, stock-raising is the main industry. The cattle feed on a thousand hills; dusty trails wind down the steep slopes of the deeply sunk watercourses; ranch buildings snuggle against the mountain sides, whence broad flats extend into the hazy distance. Lillooet, the Chilcotin, Clinton, 150 Mile House, Soda Creek, are all centres of this industry. Quesnel is the port of entry to the gold diggings of the Cariboo, where in the sixties miners took $20,000,000 worth of gold dust and nuggets from Williams Creek alone. Barkerville was for many years the central rendezvous of the placer miners. To-day an occasional strike in a forgotten river bed recalls the gleam of olden days.

From Soda Creek to Prince George the Fraser is navigable, and stern-wheel steamers carry the freight and passengers. The appearance of the landscape changes as the rainfall increases. The level of the plateau rises, the land flattens out, spruce forests clothe the hillsides, alders and cottonwoods the lowlands of the river bottoms. Around Prince George mixed farming is carried on.

The Okanagan Valley

Sicamous Junction to Oliver.—Bordering the Columbia Range on its western flank lies the fertile valley of the Okanagan Lake and River. To the west, the water-parting with the Similkameen is a high rolling plateau, interspersed with small lakes and deep-cut ravines, through which brawling streams dash down to the lake. To the east are seen the blue-ridged mountains which form the divide with the Kettle River valley, and farther north the Monashee Range interposes its barrier between the Okanagan and Arrow Lakes. Bathed in the brilliant sunshine of the dry belt, the hundred-mile trough of the Okanagan lay for a thousand years a mere gash in the great interior plateau. To-day its orchards

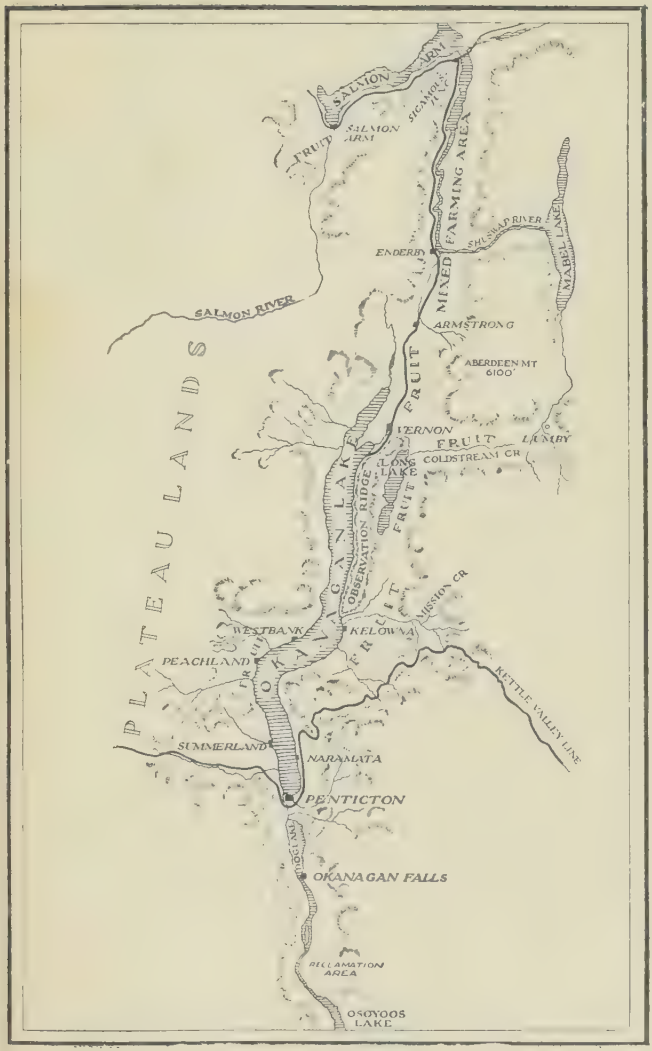


FIG. 247. SKETCH MAP OF OKANAGAN LAKE

crowd the bench lands and the ripe, red fruit finds its way to a thousand markets. This valley is the great fruit district of the province, and compares in productivity with the Niagara Peninsula of Ontario and the Annapolis and Cornwallis valleys of Nova Scotia. The miracle has been wrought within the space of a generation by the construction of a few ditches and flumes.

We may enter the Okanagan by the branch line from Sicamous Junction to Okanagan Landing at the head of the lake, where large stern-wheel steamers connect with various lake ports, the most important of which is Penticton at the southern end; or we may take the Kettle Valley line and enter the valley at its southern part via Penticton. The Canadian National is building a line from Kamloops to Vernon and may extend it as far as Kelowna. A system of excellent roads traverses the valley on both sides, and branches extend up the beds of the tributary creeks.

From Sicamous to the Boundary is 160 miles; this whole district is commonly thought of as "The Okanagan," but, in truth, that part from the Shuswap Lake to Armstrong (33 miles) lies in the drainage basin of the South Thompson. The Shuswap River rises in the mountains behind Lumby, and after emptying into Mable Lake, flows past Enderby into the south-east end of the Shuswap Lakes. The appearance of this stretch is that of the Salmon Arm type. Forests clothe the rich bottom lands and cover the hillsides; fir, spruce, cedar, and lodge-pole pine are the principal forest trees. Lumbering is one of the main industries of the Shuswap basin. The rainfall is moderate, well distributed, and irrigation is not necessary. From Mara to Armstrong the valley is wide and fertile, and mixed farming prevails. A saw-mill is located at Enderby. After supplying local needs the surplus is shipped to the prairies.

Armstrong is the centre of a rich farming district. On the higher ground fruit is grown. In the almost level bottom lands of ancient lake beds, truck gardening has been found most profitable. Celery is produced in large quantities and finds a ready market as far west as Vancouver and as far east as Regina. Four miles south of Armstrong the valley narrows, an imperceptible divide is crossed, and we enter the true Okanagan slope to the south. The whole face of the country changes, dry belt conditions appear, bull pines stand in scattered array, and the hillsides are carpeted with the short bunch grass of the range lands. Irrigation is now necessary.

Vernon is situated at the junction of three well-defined valleys. To the south-west the wide Priest valley leads to Okanagan Landing; southward lies Long Lake with its gently sloping and fertile bench lands; eastward sixteen miles to Lumby at its head stretch the

broad acres of White Valley. Due to its commanding situation, a busy town has developed. Vernon is the administrative centre for the Okanagan valley and controls the trade of a large region. Within a ten-mile radius fourteen thousand acres have been brought under irrigation, and nine thousand more are irrigable. Orchards greet the eye; miles of apple blooms in the spring, and tons of rosy-cheeked fruit in the fall. In Vernon the apple is King.

Kelowna. Forty miles below Okanagan Landing on the east side of the lake, the clay ridge separating Okanagan and Long Lakes ends abruptly and gently sloping lands stretch back from the lake shore to the distant hills eight to ten miles away. Through this semi-circular flat flow the waters of Kelowna and Mission Creeks, providing water for the large irrigation systems which serve the 40,000 acres already under cultivation. Kelowna town is prettily situated on the lake front, and serves a prosperous fruit district. Again orchards fill the landscape. Apples, cherries, plums and pears grow to perfection in the clear air and sunshine. A cannery takes care of the surplus product. Recently many acres have been devoted to tomatoes, while onions are grown in large quantities both here and in the Vernon district. Across the lake lie the smaller settlements of Peachland and Westbank. The latter is the centre of a large irrigable area estimated at 24,000 acres, while an equal amount awaits development toward Okanagan Landing.

Summerland is on the west side of the lake between Peachland and Penticton. Here a clay bank rises abruptly from the lake. There a large open flat stretches back to the encircling hills, gradually narrowing as the Trout Creek valley is encountered. Peaches were for some years the main crop, but of late, large apple orchards have come into bearing.

Naramata lies across the lake, and is developing into another Kelowna.

Penticton is situated at the foot of the lake. Its position is an enviable one, and the town is growing rapidly. Here the lake vessels connect with the Kettle Valley line. The old lake levels are continued in a number of long, narrow bench lands stretching southward along the Okanagan River. Irrigation systems are in use and a large acreage is under orchard. Peaches produce an abundant crop, but apples are the mainstay.

To the south the river flows through three small lakes, Dog, Vaseaux, and Osoyoos. The drop from Okanagan Lake (1,130 feet) to Osoyoos Lake (913 feet) is considerable for the short distance of forty miles. This feature has been utilized by the provincial government in furthering a great irrigation scheme in the wide portion of the valley between Vaseaux Lake and Osoyoos. The town of Oliver is the supply centre for these new fruit lands.

The Kettle Valley or Boundary Country

Tucked in between the Okanagan on the one side and the Columbia on the other lies the valley of the Kettle River with its tributaries, the West Kettle and the Granby. Through rolling hills and uplands, a beautiful park-like country, these rivers descend through gradually widening valleys to the parent stream. Along the upper courses the valleys are steep and narrow. Stock-raising is profitable on the higher and undulating lands, while hay, grain, and vegetables are produced where river flats exist.

At Westbridge ranches occupy the extensive bottom lands. The Rock Creek valley is a mixed farming region. Midway occupies a dry flat where the Kettle crosses into the United States. It is a distributing centre for the lower Kettle valley, and should become an important fruit area when irrigation has been secured.

Up the Boundary Creek are Boundary Falls, where power has been developed. A few miles beyond is Greenwood, the centre of an old mining region. While the railway makes a detour to the north-east via Eholt in crossing the divide to enter the Granby valley and the Grand Forks district, let us follow the river after it crosses the boundary at Midway. Rounding a mountain ridge, the Kettle reappears at Grand Forks and is there joined by the Granby from the north. After some twelve miles of indecision the Kettle River definitely crosses the boundary on its course to join the Columbia.

For a number of years Grand Forks was the centre of mining areas located up the Granby and its tributaries, at Eholt and Phœnix. A considerable tonnage of copper, silver, and gold-bearing ores was treated at the Grand Forks Smelter. But the mines have been closed down, the smelter dismantled, and the company is now engaged in mining and smelting at Anyox. The fertile lands of the valley have, however, been industriously developed, and now over two thousand acres are under fruit. Mixed farming extends to the vicinity of Christina Lake.

The Kootenay District

Topography.— Bordered on the west by the Columbia mountains [1] and by the wall of the Rockies on the east, the triangular mass of land enclosed by the 49th parallel on the south is known to all as the Kootenay.

Down the centre lies the great Selkirk Range, the giant backbone of the triangle, dividing the land into East and West Kootenay.

[1] Sometimes called the Gold Range.

The particular feature of this area is the Rocky Mountain trench which separates the Rockies from the Selkirk and Purcell systems and forms a deep trough from four to ten miles in width. Here the Columbia takes its rise in Columbia Lake, situated in the floor of the trench. Flowing through Windermere Lake, a fair-sized stream winds its way northward, gradually increasing in size as tributary streams add their quota of melted snows from the towering mountains on either hand. At the Big Bend the Columbia leaves the mountain trench to round the Selkirks. The course of the river is now irregular and many dangerous rapids are encountered. At Arrowhead the river widens to form the Arrow Lakes, then narrowing again near Castlegar, it soon crosses the

[*Courtesy Canadian Pacific Railway.*

FIG. 248. IN THE MOUNTAIN TRENCH
Lake Windermere and Club House

boundary on its way through the State of Washington and thus on to the Pacific.

But let us return to Columbia Lake. Issuing from the high ranges of the Rockies comes a river flowing into the mountain trench. This is the Kootenay, which, passing within four miles of the head of Columbia Lake turns southward and follows the trench across the boundary until the Purcell Range is circled. The Kootenay enters the province at Creston and fills the Purcell trough forming Kootenay Lake. The remainder of this depression is occupied by the Duncan and Beaver Rivers. From near the centre of the western shore of the lake, the west arm of Kootenay Lake provides an outlet for the accumulated waters, and the Kootenay River issues forth to dash down by Bonnington Falls and a series of rapids to join the Columbia at Castlegar. Ridged by towering

mountains, drained by swift-flowing rivers, interspersed with deep, dark lakes, the lands of the Kootenay district present an ever-changing view of snow-capped peak, silvery mountain torrent, or placid lake expanse. Forests cover the mountain slopes, big game abounds, and the fishing is unexcelled.

Let us now examine this section part by part and learn something of the industries which have been established.

Kootenay.—How may we get into the Kootenay district? From Sicamous Junction the main line of the Canadian Pacific Railway

[*Courtesy Canadian Pacific Railway.*

FIG. 249. REVELSTOKE FROM MOUNT REVELSTOKE
Showing Mount Begbie

passes up the Malakwa River eastward over Eagle Pass and down to the Columbia at Revelstoke. Here a branch line runs down the left bank of the Columbia to Arrowhead, where lake steamers connect with West Robson at the foot of the lakes. There an extension of the Kettle Valley line takes us eastward to Nelson, westward to Grand Forks and Penticton, or southward to Trail and Rossland.

Revelstoke is situated at the junction of the Illecillewaet and Columbia Rivers of the Selkirks, and is a divisional point on the great transcontinental system of the Canadian Pacific Railway. Car repair shops are located at this point and a large number of

[*Courtesy Canadian Pacific Railway.*

FIG. 250. CONNAUGHT TUNNEL

men are employed in the service of the company. The sloping bench lands to the south of the town are now under cultivation. Mixed farming is chiefly carried on. Several thousand acres of good land are also being cleared on the east side of the Columbia opposite the town. Lumbering was for many years the chief industry, and there is still a large production of poles, posts, and ties from this district.

A mile east of the town the railway enters the canyon of the Illecillewaet. Ascending this narrow gorge in the Selkirks, we come to the foot of Rogers Pass (altitude 4,351 feet). Here the railway penetrates the mountain divide by Connaught tunnel, a record of giant engineering skill. It is five miles long, double-tracked, and saves many miles of steep gradient which were necessary in carrying the line over the top of the pass. Descending the Beaver River, the line again strikes the Columbia, which it follows closely to Golden. Here a branch line, the Kootenay Central, connects with Crow's Nest line at Colvalli Junction not far east from Cranbrook. Leaving Golden, the Canadian Pacific ascends the Kicking Horse River to Field, the chief station in the heart of the Rockies. The divide is crossed at Stephen (altitude 5,321 feet) and the railway descends the Bow River to Calgary.

The Lands of the Mountain Trench. -Settlement is at present confined largely to that portion lying between Golden and the boundary. In this section the trench maintains an average width of about eight miles from the sloping foot of the Rockies on the east across a wide sweep to the gently rolling lands which mount to the towering rampart of the Purcells on the west. Looking south, the scene is one of serrated peaks on either hand, which merge gradually in the hazy distance as the horizon line cuts off the view. The climate is that of the dry belt, a light rainfall and the usual continental extremes of temperature. In its natural state much of the mountain trench is suitable for grazing, and cattle-ranching is extensively carried on. Mixed farming and fruit culture are proving profitable where irrigation systems have been built. Golden, Birchlands, McMurdo, Castledale, Galena, Brisco, and Edgewater are supply centres in the ninety-mile stretch from Golden to Columbia Lake. A considerable area is under cultivation around Windermere Lake, where Athalmere, Windermere, Wilmer, and Invermere are farming communities. Southward, in the valley of the Kootenay, Wasa and Fort Steele are ranching centres.

The confluence of the Elk and St. Mary's Rivers with the Kootenay provides a number of lateral valleys extending back from the trench to the heart of the mountains on either hand. Due to an increase in the amount of precipitation, this district is covered with a heavy forest growth. The species resemble those of the coast

[Courtesy Canadian Pacific Railway.

FIG. 251. MOUNT STEPHEN AND THE KICKING HORSE RIVER

forest region; Douglas fir, cedar, and hemlock are found as well as thick stands of lodge-pole or jack-pine. Lumbering is the widespread industry of this region, and mills are located at Wardner, Jaffray, Waldo, Lumberton and Yahk.

Cranbrook town is well situated on a level prairie seven miles west of the Kootenay. It is the supply centre for the southern portion of the mountain trench and a divisional point on the Crow's Nest branch of the Canadian Pacific Railway. In addition to the usual types of sawn timber and lumber for general building purposes, the South Kootenay forest lands provide millions of railway ties from the thick stands of pine. Telegraph poles, fence posts, and mine props are shipped to the adjacent prairie markets.

In the valley of the St. Mary's River is located the town of Kimberly. The great Sullivan mine near by contains one of the largest deposits of lead-zinc ore on the continent of North America. From this one mine are obtained annually nearly 50,000,000 pounds of lead and a similar quantity of zinc, the bulk of the lead and zinc produced in Canada. A huge concentrator, capable of treating 2,500 tons of ore daily, has been installed. The concentrates are shipped to Trail smelter, where the refined lead and zinc are extracted.

Up the Elk River the Crow's Nest line brings us to Fernie, the central point of the coal-mining industry of South-East Kootenay. Great beds of coal underlie the hills and outcrop along the mountain sides. Mines are found at Coal Creek, Michel, and Corbin. Coke is manufactured in long batteries of beehive ovens at Michel. The coal measures extend over the divide, and on the eastern slope of the Rockies the vast Alberta coal-fields are located. The annual production from the Fernie district amounts to some 800,000 tons. Part of this is exported to the United States; the rest is used locally and as far west as Grand Forks and Revelstoke. The coal is a high-grade bituminous and the production is limited by the existing markets. Lumbering is an industry of importance. Fernie is the distributing centre for this district.

Kootenay Lake and the lands of the Purcell Trench.—Let us follow the Crow's Nest line from Cranbrook westward through the mountains to join the Kootenay again at Creston. The 49th parallel is not far away as the train comes rumbling down the gorge which the Goat River has cut through the west slope of the Purcells. Sloping bench lands appear, and the Kootenay River, returning to the Canadian side, is seen to expand gradually through the Kootenay flats into a wide estuary and finally enters Kootenay Lake. From Erickson and Creston to Sirdar the benches along the east, or right, bank of the Kootenay are being developed. This is already a well-known fruit area. Apples, plums, pears, cherries, as well as strawberries, are grown in increasing quantities.

[Courtesy Canadian Pacific Railway.

FIG. 252. FERNIE COKE OVENS

At Kootenay Landing lake steamers take passengers around to Nelson, while car barges transfer whole trains of box cars to Proctor. It has not yet been found advisable to build the railway along the west side of Kootenay Lake.

Kootenay Lake, a beautiful sheet of water, 170 square miles in area, fills the lower portion of the Purcell Trench. On the bank of the west arm stands the city of Nelson, chief town of West Kootenay. Lake steamers ply regularly to the various lake ports. Nelson has also direct rail connection with Vancouver via the Kettle Valley line, and with Spokane via the Great Northern Railway. Nelson controls the trade of a large district. To the south, in a huge semicircle, stretches a great forest. Loggers are at work, and lumbering is one of the chief activities along the line of the Great Northern. East of the city considerable areas are devoted to fruit culture. The Kootenay apples are noted for their high colour and delicate flavour.

Below Nelson the lake narrows and the outflowing waters run swiftly between river banks. Rapids appear and then the river pours over the Bonnington Falls in two leaps; the upper one is sixty-three feet, the lower fall thirty-four feet in height: 41,000 horse-power is generated at present, and it is widely distributed. Power lines extend to Nelson and westward as far as Penticton and the valley of the Similkameen. The abundance of electrical energy is a strong factor in the development of West Kootenay.

Kaslo is a centre of trade for the northern end of Kootenay Lake, Bowser Lake, and Gerrard. The town is prettily situated on a sloping bench overlooking the lake and with a background of towering mountains. There is direct train service to Nakusp on the Arrow Lakes and with the Slocan mining properties.

The Slocan is the great silver lead district of British Columbia. Sandon, New Denver, Silverton, and Slocan City are important centres in this district. The Standard Mine at Silverton has been a great producer of the grey silver-lead ore. The ore is brought by rail and water to Slocan City, thence by rail to Trail smelter.

Trail is the home of the great smelter. Situated on the right bank of the Columbia, twenty miles below Castlegar, are the tall chimneys and widely spreading buildings of this huge enterprise. Here come the ore cars from Kimberly, coke cars from Michel, silver-lead from the Slocan and gold from Rossland: 400,000 tons of ore a year are smelted and 1,400 men are employed. Back in the mountains to the west, six miles away, and 1,700 feet above Trail, is Rossland, the great gold camp of the Kootenays. The principal mines are the Centre Star, War Eagle, and Le Roi, now grouped under one management. The camp has been a steady producer since 1895, and $85,000,000

worth of ore has been dug from the mountain sides. The veins have been followed to such an extent that now there are eighty miles of underground workings, a large part of which has been electrified.

The Arrow Lakes.—As their name implies, they are long, narrow, lake like expansions of the main Columbia River. Here and there huge shoulders of the mountain masses thrust down abruptly into the lake. Between these are the fertile bench lands where fruit culture and mixed farming are carried on. Robson, Burton

[*Courtesy Canadian Pacific Railway.*

FIG. 253. TRAIL SMELTER, B.C.

City, Edgewood, West Demars, Arrow Park, and Needles are the chief farming areas.

From Nakusp, the busy trading centre of the Arrow Lakes, a short rail route leads into the Slocan.

From Prince Rupert to Lucerne

The Skeena.—The central portion of British Columbia is entered on the east by the Yellow Head Pass (3,716 feet), and on the west by the valley of the Skeena and its tributary, the Bulkley. The Skeena River (325 miles) rises in the rolling plateau which borders the western slopes of the Cassiar mountains. Within a short distance are also found the headwaters of the Nass and the

Stikine. Across the Cassiars to the eastward the tributaries of the Finlay take their rise.

To its junction with the Babine the upper valley of the Skeena is wide and in places terraced. It is enclosed by long even ridges which merge into isolated groups of high rugged peaks. Similar formations are found in the upper valleys of the Nass and Stikine. These valleys are practically unoccupied, and the whole region is a vast untouched forest, of ten billion feet of standing timber.

[Courtesy Canadian National Railways.

FIG. 254. PYRAMID FALLS

Babine Lake, 105 miles in length, is drained by a deep-sunk rushing torrent which becomes the largest tributary of the Upper Skeena. At Hazelton the Bulkley joins the Skeena from the southward and the main stream enters upon its course through the Coast mountains to the sea, 170 miles distant. Through the cut worn by the river the northern branch of the C.N.R. reaches the sea at Prince Rupert.

Unlike the Fraser, no wide delta lands are found at the Skeena mouth. The mountains throw their bold shoulders down to

the sea, and the river for some miles resembles an inlet or canal. Rocky islets divide the channel into several parts. The great industry is salmon-fishing. Canneries are located at Smith Island, Port Edwards, Inverness, Dominion, Sunnyside, North Pacific, Cassiar, Haysport and Essington. The latter town was for many years the port where river steamers connected with coast vessels.

The railroad from Prince Rupert follows the north bank of the river. "The trough-shaped valley of the Skeena is seldom less than a mile wide, and the river, split into a number of channels, swings from bank to bank, washing alternately the slopes on either side, alluvial flats being found in the alternating spaces." The mountains rise steeply on either hand, "boldly sculptured," with distant peaks showing the clear green of glaciers down their sides.

Terrace and its vicinity.—Ninety-six miles from Prince Rupert we enter a new and rapidly developing area. A wide trough extends from Kitimat Arm to Aiyansh on the Nass. The front wall of the Coast Range has been passed. To the east lie parallel spurs of the main range extending to Hazelton and beyond. Terrace is the largest town in the Skeena valley and the centre from which roads lead to the farming lands of the Kitsumgallum and Lakelse trench valleys. The wide flats are forested and sawmills are in operation. Agriculture is making rapid strides. The climate is mild and the rainfall moderate. Strawberries are grown in increasing quantities, while other berries and tree fruits do well. Root crops yield abundantly, and grain is grown. "Potatoes rival the best produced anywhere." Thirteen miles east of Terrace we come to Usk, where four lumber mills give employment to several hundred men. A cable ferry crosses the Skeena to Kleanza Creek, where gold-silver-copper ores are being worked. Near Copper City up the Zymoetz River are huge deposits of iron ore, and on Coal Creek are coal areas.

Pacific is a divisional point, twelve miles beyond Usk. Cedarvale and Kitwanga are Indian settlements. The walls of the Skeena now contract and the river runs swiftly through a long canyon. At Skeena Crossing the railway passes to the south bank over a bridge 140 feet above the water level.

Hazelton.—The old town, with a population of about 400, is prettily situated on a flat between the Bulkley and Skeena Rivers. There is a large Indian village near by. Here the Indians have congregated from time immemorial. Here their council meetings were held, and their war parties assembled. Along the banks of the rushing waters they speared the salmon and laid by goodly store for winter food. In 1868 the first fur-traders appeared, and Hazelton is still an important fur-post of the north country.

Roads lead from Hazelton up the Kispiox valley, where some

[*Courtesy Canadian National Railways.*

FIG. 255. SUSPENSION BRIDGE AND OLD INDIAN BRIDGE, HAZELTON
The Old Indian Bridge is now down

good farms are already under cultivation. A trail crosses the Babine Range to the old placer diggings of the Omineca district. Still another road leads up the Bulkley to the canyon where a suspension bridge 420 feet long and 240 feet above the rapids leads to New Hazelton. Near by is the old Indian village of Hagwilget, noted for many years as the site of a unique Indian suspension bridge made of wood and lashed together with wire.

New Hazelton is situated on the railway south of the Bulkley, where Rocher Deboule Mountain fills the southern sky-line with its rugged mass. Mines have been opened and shipments have been fairly steady since the completion of the railway in 1914. Over two million dollars worth of copper, silver, gold, lead, and zinc have been secured from the mines of this section.

The Bulkley Valley

The railway leaves the Skeena at South Hazelton and follows the Bulkley valley southward to its head, a distance of 120 miles. The first twenty-five miles to Moricetown the valley is narrow, with the river dashing down through a deep-walled canyon. The central portion of the valley (Moricetown to Houston) maintains an average width of about five miles.

Smithers (population 600) is the largest town in the valley. Mixed farming prevails. Kathlyn Lake at the foot of Hudson Bay Mountain is a summer resort.

To the east lies **Telkwa,** a busy agricultural centre and shipping point for the coal which is being mined from a seam four miles up the Telkwa River. Good farming lands extend to Houston. Beyond this point the valley narrows and the railway crosses the divide (2,359 feet) and enters the Endako valley. Altogether about 200,000 acres of arable land lie within the Bulkley valley.

Burns Lake is the chief trading centre of the Endako valley. Roads lead north to Babine Lake and south to Francois Lake. Fort Fraser of to-day is located on the railway, one and a half miles south-east of the old Hudson Bay trading post, which stood at the east end of Fraser Lake near the Nautley Indian village.

Below Fraser Lake the Nechako valley widens into a broad, gently undulating expanse, which provides the largest area of practically level agricultural land in Central British Columbia. For a distance of forty miles the Nechako lands maintain a width of twenty miles. The soil is a deep silt, lightly timbered; fodder crops are grown extensively and dairying is a leading occupation.

Vanderhoof (population 450) is the chief commercial centre for this region. It is built on a wide flat between the railway and the river and is growing rapidly. A creamery has been built

to meet the needs of the farmers. Roads lead to Fort St. James at the south end of Stuart Lake, to Fort Fraser and the east end of Francois Lake, to Prince George and south to the Cariboo Road.

Twenty miles below Vanderhoof the Stewart River empties into the Nechako from the north. Many thousand acres of rich bottom land have been pre-empted in this valley.

Prince George (population 3,000). Situated on a flat between the Nechako and Fraser Rivers, it is the bustling business centre of Central British Columbia. A thousand miles of navigable river-ways join at this spot. The city is located midway between Edmonton and Prince Rupert. The Pacific Great Eastern is projected to run through Prince George from the south and may be continued northward to the Peace River country. The city is a business and administrative centre and controls the trade of the Stewart, Salmon and Central Fraser River valleys. Many valuable peltries find their way to this mart. Settlement has been rapid of late years and large tracts have been cleared and put under the plough. Mixed farming prevails; root and fodder crops are grown, large quantities of hay are cut; cattle, swine and sheep are increasing rapidly.

The railway crosses the Fraser at Prince George and follows the east bank to Willow River, where a short cut to the intermontane trench is provided via Eaglet and Hansard Lakes. Forests of cedar, spruce and Engelmann fir cover the entire region of the Willow River and Upper Fraser. Eighteen lumber mills are in operation between Prince George and McBride, at Willow River, Giscome, Aleza Lake, Dewey, Longworth, Hulton, Penny, Dome Creek, Loos and Dunster. There is an estimated twenty billion feet of timber in this region.

For 190 miles southward to the head of the Canoe River the mountain trench averages five miles in width with the Fraser winding from side to side. Alluvial flats screened with willow and alder stretch back to the terraced bench lands. These in turn give place to rampart walls six thousand feet in height.

McBride is the largest town in the valley and a divisional point on the railway which parallels the river. At Tête Jaune Cache the railway crosses McLennan River and unites with the North Thompson branch of the system. Ascending the Fraser the line passes close to Mount Robson, 13,068 feet, the highest peak in the Canadian Rockies. Here a large area has been set aside as Jasper National Park, and each year sees an added interest in this beautiful national playground. A few miles beyond Lucerne the railway crosses Yellowhead Pass (altitude 3,723), the lowest pass in use in the whole Rocky Mountain system.

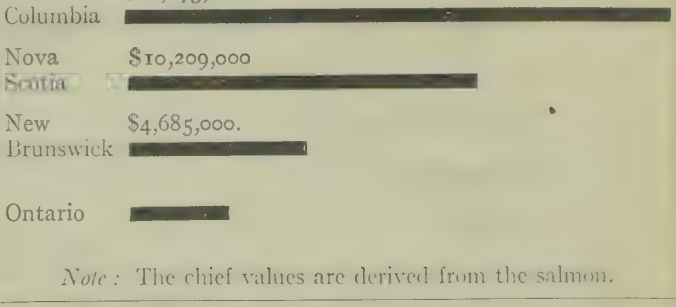
The Peace River District.—The northern part of the Rocky

[*Courtesy Canadian National Railways.*

FIG. 256. MOUNT ROBSON

COMPARATIVE PRODUCT CHART

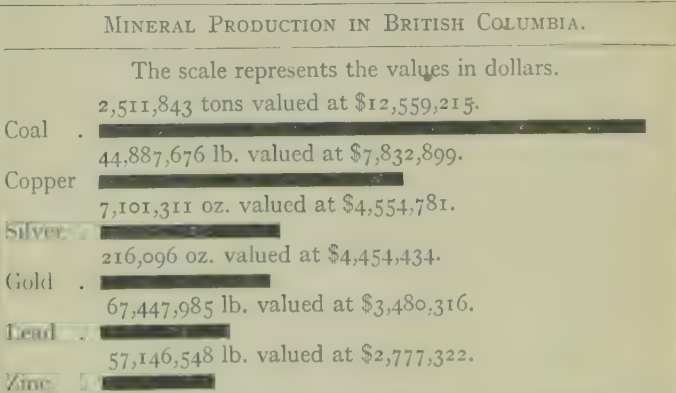
British Columbia leads in the Production of Fish.



Note: The chief values are derived from the salmon.

Mineral Production in British Columbia.

The scale represents the values in dollars.



Note: British Columbia produces nearly all the lead and zinc mined in Canada and by far the larger part of the copper.

Leading Mineral Production in the other Provinces for Comparison.

Coal . Nova Scotia, 6,400,000 tons; Alberta, 6,300,000 tons, ann.
Gold . Ontario, 1,000,000 oz. valued at $20,668,602.
Nickel . Ontario, 61,335,706 lb. valued at $24,534,280.
Silver . Ontario, 9,997,626 oz. valued at $6,996,795.
Asbestos Quebec, 100,573 lb. valued at $14,792,200.

COMPARATIVE PRODUCT CHART

British Columbia Leads in the Production of Lumber.

British Columbia	Log scale = 2,542,280,000 board feet.
	1,391,600,000 board feet.
Quebec	
	992,900,000 board feet.
Ontario	
New Brunswick	515,800,000 board feet.
Nova Scotia	274,000,000 board feet.

Note: In 1923 the value of the forest products of British Columbia passed $70,000,000.

Agriculture in British Columbia.

	Quantity	Value
Live Stock.	412,332 head	$14,550,494
Meat Products.	23,143,411 lb.	1,413,911
Poultry and Eggs.	7,189,276 lb. 6,069,217 doz.	4,015,838
Dairy Products.	—	8,001,135
Fruits.	176,802,927 lb.	4,915,604
Vegetables.	244,884 tons	5,847,772
Hay and Fodder Crops.	518,804 tons	12,467,332
Grains.	4,172,095 bu.	3,486,726
Honey.	711,356 lb.	177,839
Wool.	300,000 lb.	48,500
Hops.	680,901 lb.	272,360
Miscellaneous.	—	125,460
Total.		$55,322,971

Manufacturing in British Columbia.

No. of Plants operating.	2,809
Capital value.	$268,419,281
No. of Employees.	55,000
Wages Paid.	$86,192,190
Gross Values Produced.	$239,784,988

Mountain trench is drained by the Parsnip and Finlay Rivers. Their united waters form the Peace River, which breaks through the Rockies and flows eastward, a distance of eight hundred miles, to join the Mackenzie system near the outflow of Lake Athabasca. The Peace flows through a gently rolling expanse similar in appearance to the lands of the Saskatchewan. The main river bed, together with its tributary streams, is deeply sunk (six to eight hundred feet) below the general level. Wide flats give place to steep, grass-covered slopes, and these in turn to flat-topped prairies. The soil is a deep, black loam, very fertile, and with abundant rainfall during the growing season. The days are long in summer and the vegetation matures rapidly. All the main root crops are successfully grown, and grain is produced. A few ranches are devoted to stock-raising.

Settlement has been confined largely to the south-eastern portion of the Peace River block. This is a rectangular area of about three and a half million acres extending westward from the Alberta boundary for a distance of seventy miles. It was given to the Dominion as a land grant in connection with the building of the Canadian Pacific Railway. The need to-day of the lands of the whole Peace River district is direct rail communication with either Edmonton on the one hand or with Prince George on the other. At present the branch line which runs north from Edmonton stops at Spirit Crossing. It is then fifty-five miles by dirt road to Pouce Coupe, the first large settlement in the Peace River block. About 1,500 people reside in this section, where good farms, stores, churches and schools are to be found. Rolla is thirteen miles to the northward and is a farming section about half the size of Pouce Coupe. It has been estimated that one-third of the area of the block is suitable for agriculture. Its further development awaits the completion of railway transportation.

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